Getting Started

NXHX 51-ETM

Hilscher Gesellschaft für Systemautomation mbH

www.hilscher.com

DOC130701GS02EN | Revision 2 | English | 2013-10 | Released | Public

Table of Contents

1 INTRODUCTION 4
1.1 About this Document 4
1.1.1 Description of the Contents 4
1.1.2 List of Revisions 4
1.1.3 Conventions in this Manual 4
1.2 Legal Notes 5
1.2.1 Copyright 5
1.2.2 Important Notes 5
1.2.3 Exclusion of Liability 6
1.2.4 Warranty 6
1.2.5 Export Regulations 7
1.2.6 Registered Trademarks 7
2 DESCRIPTIONS OF THE USE CASES 8
2.1 Overview 8
2.2 Using Standard Loadable Firmware 8
2.2.1 What Is Standard Loadable Firmware ? 8
2.2.2 Loadable Firmware and Second Stage Bootloader 9
2.2.3 Downloading SSBL and LFW to Serial Flash of NXHX 51-ETM Board 9
2.3 Using LOM Firmware 10
2.3.1 What Is LOM Firmware ? 10
2.3.2 Using the Application Examples on the Product DVD 12
2.3.3 Downloading (Flashing) LOM Firmware to NXHX 51-ETM Board 15
3 DEVICE DRAWING AND POSITIONS OF THE NXHX 51-ETM 16
4 CONNECTING POWER SUPPLY 18
5 STEP-BY-STEP INSTRUCTIONS FOR TYPICAL USE CASES 19
5.1 Installing Code Sourcery Compiler on Your Development PC 19
5.1.1 Overview 19
5.1.2 Prerequisites 19
5.1.3 Step-by-Step Instructions 19
5.2 Using Waf to Build ELF Files from All Application Examples 20
5.2.1 Overview 20
5.2.2 Prerequisites 20
5.2.3 Step-by-Step Instructions 20
5.3 Using Waf to Build an ELF File from an rcX Application Example 22
5.3.1 Overview 22
5.3.2 Prerequisites 22
5.3.3 Step-by-Step Instructions 22
5.4 Using HiTOP to Build, Download and Debug an ELF File Made from an rcX Application Example 28

5.4.1 Overview......28
5.4.2 Prerequisites......28
5.4.3 Step-by-Step Instructions......28
5.5 Using Bootwizard to Create an Executable Binary Firmware File from ELF File......42
5.5.1 Overview......42
5.5.2 Prerequisites......42
5.5.3 Step-by-Step Instructions......42
5.6 Downloading Executable Binary Image to Serial Flash of the NXHX 51-ETM via USB......46
5.6.1 Overview......46
5.6.2 Prerequisites......46
5.6.3 Step-by-Step Instructions......47
5.7 Downloading NXF Firmware to Serial Flash of the NXHX 51-ETM via USB......56
5.7.1 Overview......56
5.7.2 Prerequisites......56
5.7.3 Step-by-Step Instructions......57
5.8 Downloading NXF Firmware via PCI and Host Interface......63
5.8.1 Overview......63
5.8.2 Prerequisites......63
5.8.3 Step-by-Step Instructions......64
5.9 Configuring NXHX 51-ETM With SYCON.net......75
5.9.1 Overview......75
5.9.2 Prerequisites......75
5.9.3 Step-by-Step Instructions......76
5.10 Testing I/O Communication......96
5.10.1 Overview......96
5.10.2 Prerequisites......96
5.10.3 Step-by-Step Instructions......97
6 APPENDIX......105
6.1 List of Figures......105
6.2 List of Tables......108
6.3 Contacts......109

1 Introduction

1.1 About this Document

1.1.1 Description of the Contents

This Getting Started Guide describes typical use cases for the Hilscher NXHX 51-ETM Development Board.

1.1.2 List of Revisions

Index	Date	Chapter	Revisions
1	2013-08-30	All	Created
2	2013-10-23	5.9	Section *Configuring NXHX 51-ETM With SYCON.net* added
		5.10	Section *Testing I/O Communication* added

Table 1: List of Revisions

1.1.3 Conventions in this Manual

Notes, operation instructions and results of operation steps are marked as follows:

Notes

Important: <important note>

Note: <note>

<note, where to find further information>

Operation Instructions

1. <instruction>
2. <instruction>

or

➢ <instruction>

Results

➯ <result>

1.2 Legal Notes

1.2.1 Copyright

© Hilscher 2013, Hilscher Gesellschaft für Systemautomation mbH

All rights reserved.

The images, photographs and texts in the accompanying material (user manual, accompanying texts, documentation, etc.) are protected by German and international copyright law as well as international trade and protection provisions. You are not authorized to duplicate these in whole or in part using technical or mechanical methods (printing, photocopying or other methods), to manipulate or transfer using electronic systems without prior written consent. You are not permitted to make changes to copyright notices, markings, trademarks or ownership declarations. The included diagrams do not take the patent situation into account. The company names and product descriptions included in this document may be trademarks or brands of the respective owners and may be trademarked or patented. Any form of further use requires the explicit consent of the respective rights owner.

1.2.2 Important Notes

The user manual, accompanying texts and the documentation were created for the use of the products by qualified experts, however, errors cannot be ruled out. For this reason, no guarantee can be made and neither juristic responsibility for erroneous information nor any liability can be assumed. Descriptions, accompanying texts and documentation included in the user manual do not present a guarantee nor any information about proper use as stipulated in the contract or a warranted feature. It cannot be ruled out that the user manual, the accompanying texts and the documentation do not correspond exactly to the described features, standards or other data of the delivered product. No warranty or guarantee regarding the correctness or accuracy of the information is assumed.

We reserve the right to change our products and their specification as well as related user manuals, accompanying texts and documentation at all times and without advance notice, without obligation to report the change. Changes will be included in future manuals and do not constitute any obligations. There is no entitlement to revisions of delivered documents. The manual delivered with the product applies.

Hilscher Gesellschaft für Systemautomation mbH is not liable under any circumstances for direct, indirect, incidental or follow-on damage or loss of earnings resulting from the use of the information contained in this publication.

1.2.3 Exclusion of Liability

The software was produced and tested with utmost care by Hilscher Gesellschaft für Systemautomation mbH and is made available as is. No warranty can be assumed for the performance and flawlessness of the software for all usage conditions and cases and for the results produced when utilized by the user. Liability for any damages that may result from the use of the hardware or software or related documents, is limited to cases of intent or grossly negligent violation of significant contractual obligations. Indemnity claims for the violation of significant contractual obligations are limited to damages that are foreseeable and typical for this type of contract.

It is strictly prohibited to use the software in the following areas:

- for military purposes or in weapon systems;
- for the design, construction, maintenance or operation of nuclear facilities;
- in air traffic control systems, air traffic or air traffic communication systems;
- in life support systems;
- in systems in which failures in the software could lead to personal injury or injuries leading to death.

We inform you that the software was not developed for use in dangerous environments requiring fail-proof control mechanisms. Use of the software in such an environment occurs at your own risk. No liability is assumed for damages or losses due to unauthorized use.

1.2.4 Warranty

Although the hardware and software was developed with utmost care and tested intensively, Hilscher Gesellschaft für Systemautomation mbH does not guarantee its suitability for any purpose not confirmed in writing. It cannot be guaranteed that the hardware and software will meet your requirements, that the use of the software operates without interruption and that the software is free of errors. No guarantee is made regarding infringements, violations of patents, rights of ownership or the freedom from interference by third parties. No additional guarantees or assurances are made regarding marketability, freedom of defect of title, integration or usability for certain purposes unless they are required in accordance with the law and cannot be limited. Warranty claims are limited to the right to claim rectification.

1.2.5 Export Regulations

The delivered product (including the technical data) is subject to export or import laws as well as the associated regulations of different counters, in particular those of Germany and the USA. The software may not be exported to countries where this is prohibited by the United States Export Administration Act and its additional provisions. You are obligated to comply with the regulations at your personal responsibility. We wish to inform you that you may require permission from state authorities to export, re-export or import the product.

1.2.6 Registered Trademarks

HiTOP is a trademark of Hitex Development Tools GmbH.

Sourcery G++ is a trademark of CodeSourcery, Inc.

Windows® XP, Windows® 7 and Windows® 8 are registered trademarks of Microsoft Corporation.

2 Descriptions of the Use Cases

2.1 Overview

The NXHX 51-ETM Development Board can be operated with ready-made Standard Loadable Firmware (LFW) or with customer-engineered firmware based on Linkable Object Modules (LOM).

LFW files for immediate usage can be obtained from Hilscher. The product DVD of the NXHX 51-ETM board contains a loadable PROFINET IO Device firmware file with limited IO data exchange (2 Bytes) for testing and evaluation purposes.
In case you want to create and use your own firmware based on LOM, the DVD provides precompiled rcX and protocol libraries, build tools and source code of application examples which can be integrated into your LOM firmware. The product DVD also provides tools for downloading files to the serial flash memory of the NXHX board.

2.2 Using Standard Loadable Firmware

2.2.1 What Is Standard Loadable Firmware ?

Standard Loadable Firmware (LFW) is a binary code with an executable image containing a certain protocol stack and the rcX operating system for the netX controller. All LFW files are in the NXF format, and can thus be recognized by their **.nxf** file extension.

LFW is “ready-to-use”: after downloading the firmware and a configuration file to the board, the device is immediately ready for fieldbus communication. It is thus the easiest way to operate the NXHX 51-ETM for testing and development purposes. Once downloaded and stored in the non-volatile flash memory of the NXHX board, the firmware is available on each netX boot process.
In case you want to use or test a different network protocol, you can easily switch the protocol by just downloading a new LFW file containing the desired protocol stack (you might also need to change the fieldbus adapter/connector hardware on the board). LFW can be purchased from Hilscher.

Using LFW is ideal for users who want to utilize the Dual Port Memory (DPM) of the netX in a double-chip architecture, in which the netX on the NXHX board is accessed and controlled by an application running in the processor of a customer-engineered host system or Windows PC.
By using LFW, the developer can concentrate on testing network communication with the netX 51 controller on the NXHX 51-ETM and on programming and debugging his host application.

For more detailed information about LFW, please refer to the Application Note *Loadable Firmware – How To Use Loadable Firmware*, DOC090903ANxxEN, which is stored in the `Documentation\2. Application Notes\2. How To Use Loadable Firmware` directory of the NXHX 51-ETM product DVD.

2.2.2 Loadable Firmware and Second Stage Bootloader

Standard Loadable Firmware can not be booted directly by the ROM code (ROM Loader) residing in the netX controller. LFW needs to be started by a software module called **Second Stage Bootloader** (SSBL).
Therefore, operating your NXHX 51-ETM with LFW requires the SSBL file on the board. The SSBL must be downloaded and running on the NXHX board before you can download or boot any LFW file. The appropriate SSBL for your board is the **NETX51-BSL.bin** file. This file is stored in the `Tools\2nd Stage Bootloader` directory of the product DVD.

The SSBL can be downloaded and stored "non-volatile" in the serial flash of the NXHX 51-ETM board. After download to flash, the SSBL will be started by the ROM loader after every power-on reset of the board (given that flash boot mode is configured). The SSBL then in turn starts the firmware.

2.2.3 Downloading SSBL and LFW to Serial Flash of NXHX 51-ETM Board

There are several ways to download ("flash") the Second Stage Bootloader and the Loadable Firmware to the serial flash memory of the NXHX 51-ETM board from a Windows PC.
For flashing the SSBL file, Hilscher recommends to use the **netX Bootwizard** tool and serial interface (USB or COM Port). Instructions for this method are provided in the *Downloading Executable Binary Image to Serial Flash of the NXHX 51-ETM via USB* section on page 46 of this Getting Started Guide. An installation program for the Bootwizard can be found on the product DVD in the `Tools\Bootwizard` directory.

Like the SSBL, the LFW can also be flashed to the board from a Windows PC via serial interface (USB or COM Port). Hilscher recommends to use the **netHOST Device Test Application** for this. Instructions for this method are provided in the *Downloading NXF Firmware to Serial Flash of the NXHX 51-ETM via USB* section on page 56. The netHOST Device Test Application can be found on the product DVD in the `Tools\netX Transport` directory.
If you are using a Windows PC as host device for the NXHX board, you can also download the firmware from the PC via PCI and host interface (i. e. parallel Dual-Port Memory). You need an adapter and a cable for this, which can be purchased from Hilscher. This method is described in the *Downloading NXF Firmware via PCI and Host Interface* section on page 63.

If you are using a customer-engineered host system not based on Windows, you can, of course, also implement a customized download function for firmware files via host interface in your own host application. You can use the **cifX Toolkit**, which is provided on the product DVD in the `Driver and Toolkit\Driver Toolkit (NXDRV-TKIT)\cifXToolkit` directory, to develop a driver enabling communication between your host system and the Dual-Port Memory of the netX 51 (parallel or serial DPM).

For more detailed information about the cifX Toolkit, please refer to the Toolkit Manual *cifX/netX Toolkit – DPM*, DOC090203TKxxEN, which is stored in the `Driver and Toolkit\Driver Toolkit (NXDRV-TKIT)\Documentation` directory of the product DVD.

2.3 Using LOM Firmware

2.3.1 What Is LOM Firmware ?

As an alternative to using Standard Loadable Firmware, you can also create your own customized firmware based on **Linkable Object Modules (LOM)**. When using LOM, you can choose whether you want to create an **executable binary** firmware file (which can be directly started by the **ROM Loader** residing in the netX controller) or if you want to create firmware in **NXF** format.

You can use the **Waf** framework as meta build system or **HiTOP** as integrated development environment (IDE) for creating an ELF, which then can be downloaded to the NXHX board for debugging. Both build systems/environments use **Mentor Code Sourcery GNU (GCC)** as tool for compiling C source code. After debugging, you can use the Waf framework to build LOM firmware in NXF format or as executable binary file, which can be stored in the serial flash memory of the NXHX board. You can also use the netX Bootwizard to turn an ELF into an executable binary file.

Like Loadable Firmware, LOM firmware basically consists of the **rcX** (the operating system of the netX controller) and the stack of the chosen protocol, but unlike LFW, LOM can be augmented by a customer application.
The DVD provides ready-to-use C source code and headers of application examples, together with ready-to-use Waf build scripts (**wscript** files) and project files for HiTOP (**HTP** files). Precompiled libraries of the rcX and of various protocol stacks are also provided on the product DVD.
The Waf build scripts and the HiTOP project files organize and control the **tool chain** which compiles the source code of the application examples and links and assembles the resulting object files together with the rcX and stack libraries into the ELF.
Of course, you can also write your own application code or adapt/customize the provided code, and then use Waf or HiTOP for compiling and creating objects, and link them together with the provided libraries into an ELF.

The produced ELF can then be downloaded to the netX 51 controller for testing and debugging. The ELF runs only “volatile” in the netX, i. e. it can not be stored in the serial flash of the NXHX board in order to be automatically available for booting after each power-on reset. Therefore, after successful testing and debugging, you need to create an executable binary firmware file or a firmware file in NXF format, which can be downloaded and stored “non-volatile” in the serial flash memory of the NXHX board. The Waf framework is capable of building LOM firmware in NXF format or as executable binary file from the debugged source code and the libraries. Waf uses the Hilscher **netX Bootwizard**, respectively the **bootblocker.bat** as tools for this.
As an alternative, you can also build an ELF first, e. g. with HiTOP, and then open it in the netX Bootwizard and turn it into an executable binary file.

The Bootwizard can also be used to download bootable images and other files to the flash memory of the NXHX board.

For more detailed information about the Bootwizard, please refer to the Operating Instruction Manual *netX Bootwizard*, DOC070502OIxxEN, which is stored in the `Documentation\4. Tool Manuals\Bootwizard` directory of the NXHX 51-ETM product DVD.

2.3.1.1 LOM Firmware in NXF Format

Like standard Loadable Firmware (which is also in NXF format), LOM firmware in NXF format can not be booted directly by the ROM Loader residing in the netX controller. Firmware in NXF format is started by a software module called **Second Stage Bootloader** (SSBL). Therefore, operating your NXHX 51-ETM with LOM firmware in NXF format requires the SSBL on the board. The SSBL must be downloaded and running on the NXHX board before you can download or boot your firmware file.

For more detailed information about the Second Stage Bootloader, please refer to the Function Description *Second Stage Boot Loader*, DOC070301FDxxEN, which is stored in the `Driver and Toolkit\Driver Toolkit (NXDRV-TKIT)\Documentation` directory of the product DVD.

Using LOM firmware in NXF format together with the SSBL has some advantages over using firmware in ordinary executable binary format, because the SSBL provides functions which otherwise would have to be performed by the firmware itself, such as:

- creating a file system in the serial flash memory,
- validating firmware against hardware data stored in the security memory,
- setting up SDRAM,
- relocating firmware,
- setting up host interface (HIF) parameters.

Because the SSBL carries all relevant hardware parameters in its **Tag List**, it is possible to keep the firmware as independent from the hardware as possible. Hilscher therefore recommends building LOM firmware for the NXHX 51-ETM board in NXF format.

If hardware parameters need to be changed, you can do so by editing the tag list of the SSBL. A tool called **Tag List Editor** for editing tag lists is provided on the product DVD in the `Tools\Tag List Editor` directory.

For more detailed information about the Tag List Editor, please refer to the Operating Instruction Manual *Tag List Editor – Viewing and Editing Tags*, DOC110306OIxxEN, which is stored in the `Documentation\4. Tool Manuals\Tag List Editor` directory of the product DVD.

Using firmware in NXF format also makes firmware update faster and easier, because a new firmware file can be downloaded to the serial flash memory of the NXHX board via host interface. The necessary file system in the serial flash and the host interface are both set up by the SSBL. In contrast to this, when using firmware in executable binary format, there is no SSBL performing these tasks, and thus the binary firmware would need to be updated via serial interface, making the whole procedure more time consuming.

2.3.1.2 LOM Firmware in Executable Binary Format

If you decide to create your LOM firmware as ordinary executable binary file, and not in NXF format, the functions (if needed) which otherwise would be performed by the Second Stage Bootloader now must be performed by the executable firmware itself.

The executable binary LOM firmware also needs a **Boot Header**, so that it can be booted by the ROM Loader of the netX controller. The Boot Header is created and added to the executable binary by the **netX Bootwizard** application.

2.3.2 Using the Application Examples on the Product DVD

2.3.2.1 Overview

The product DVD of the NXHX 51-ETM provides different types of application examples for the NXHX 51-ETM evaluation board. After using the **HiTOP** IDE or the **Waf** build framework to build ELF files out of these examples, you can debug the produced ELF.
After debugging, you can use the **netX Bootwizard** to turn an ELF into an executable binary file, which can be stored in the serial flash memory of the NXHX board. An example of firmware in NXF format, which can be produced with Waf, is provided in the `Examples and API\LOM\2. LOM Build LFW` directory. The wscript contained in that directory produces a PROFINET IO Device firmware in NXF format with limited IO data exchange (2 Bytes).

The `Examples and API` folder contains the following sub-directories:

HAL: Contains source code for Hardware Abstractions Layer programs with direct access to the netX hardware resources.
You can use HiTOP or Waf to build ELF files out of theses examples.

LFW: The `1. LFW netX Toolkit\Firmware\PROFINET` directory contains a Loadable Firmware file for PROFINET IO Device with limited IO data exchange (2 Bytes)
The `1. LFW netX Toolkit\cifXTKitHWFunctions` directory contains an example of a host application based on the cifX Toolkit for the provided LFW file.

LOM: The `1. LOM FB RTE` folder contains source code and protocol stack libraries for building software examples with communication protocol support. You can use HiTOP or Waf to build ELF files out of these examples.
The `2. LOM Build LFW` folder contains code, library and a customized wscript file for building a PROFINET IO Device firmware in NXF format with Waf. This LOM firmware is also limited to 2 Bytes IO data exchange.

nonOS: Contains embedded software programs without OS (rcX), typically specialized for the particular netX hardware. You can use HiTOP or Waf to build ELF files out of theses examples.

rcX: Contains rcX based software examples with driver- and kernel-functionality for peripheral and interface support. You can use HiTOP or Waf to build ELF files out of theses examples.

2.3.2.2 Limited Libraries for the Protocol Stacks

Note that the libraries for the protocol stacks provided on the DVD are intended for testing and development purposes only. They are therefore limited in their functions. The limitations are:

CANopen Slave library 3.5.1.0:

- Node ID: 32
- One PDO per direction
- Maximum 2 Byte for each PDO

CCLink Slave library 2.9.2.0:

- Slave Station Address: 32
- Station type: only Remote IO
- CCLink Version: V1.1
- Fix 2 Byte In- and Output

DeviceNet Slave library: 2.3.21.0

- Fix 2 Byte In- and Output

EtherCAT Slave library: 4.2.9.0

- 2 Byte Input and Output PDO

EtherNet/IP Adapter library: 2.7.7.3

- IP Address: freely selectable
- Fixed instance number of input assembly: 0x100
- Fixed instance number of output assembly: 0x101
- Process Data size: 2 Byte Input/Output

Open Modbus/TCP Messaging Device library: 2.5.8.1

- IP Address: freely selectable
- Max Register counter: 2
- Max Coils counter: 32
- Process Data size: 2 Byte Input/Output

PROFIBUS DP Slave library: 2.6.6.0

- Network Station Address: 32
- 2 Byte Input and Output Modules

PROFINET IO IRT Device library: 3.5.13.1

- IP Address: freely selectable
- 2 Byte Input and Output Modules

sercos Slave library: 3.1.18.0

- IP Address: freely selectable
- Number of slaves: 1

2.3.2.3 Using HiTOP to Build an Application Example

If you use HiTOP, you can directly download and debug the produced ELF file via the Onboard USB HiTOP Debugger of the NXHX 51-ETM board. Step-by-step instructions for this are given in section *Using HiTOP to Build, Download and Debug an ELF File Made from an rcX Application Example* on page 28.

2.3.2.4 Using Waf to Build the Application Examples

If you use Waf, you can build all application examples provided on the product DVD at once, simply by executing the **Build.bat** batch file located in the `Examples and API` directory from a Command Prompt. You only have to specify whether you want to build the ELF files (respectively the libraries) for debugging or release purposes by entering a “debug” or “release” option. All produced output will be stored in the `Examples and API\build` directory in the `debug` or `release` folder according to the option you have specified. Detailed instructions for this are provided in the *Using Waf to Build ELF Files from All Application* Examples section on page 20.

If you want to build only one or certain examples, you can do so by specifying a target in the Command Prompt or in the Build.bat batch file. Detailed instructions for this are provided in the *Using Waf to Build an ELF File from an rcX Application Example* section on page 22.

After building an ELF for debugging, you need a hardware debugger to download and debug the ELF. This can be the Onboard USB HiTOP Debugger or any other debugger like e. g. the Lauterbach LA-7690 Power-Trace-ETH 512M via the ETM interface or a JTAG debugger via JTAG-ETM adapter and ETM interface.

2.3.3 Downloading (Flashing) LOM Firmware to NXHX 51-ETM Board

2.3.3.1 Downloading LOM Firmware in Executable Binary Format

LOM Firmware in executable binary format can be downloaded and stored in the serial flash memory of the NXHX 51-ETM board by the **netX Bootwizard** tool via serial interface (USB or COM Port). The procedure of downloading the executable firmware is the same as for downloading a Second Stage Bootloader file, because both files are in essence executable binary images. Thus, if you want to download the executable binary after having created it from ELF, you can follow the instructions provided in the *Downloading Executable Binary Image to Serial Flash of the NXHX 51-ETM via USB* section on page 46; simply select the executable binary firmware instead of the SSBL file for download.

2.3.3.2 Downloading LOM Firmware in NXF Format

LOM Firmware in NXF Format can be downloaded and stored in the serial flash memory of NXHX 51-ETM board in the same way as the Standard Loadable Firmware, i. e. via serial interface (USB or COM Port) and by using the **netHOST Device Test Application** (see *Downloading NXF Firmware to Serial Flash of the NXHX 51-ETM via USB* section on page 56).

As an alternative, firmware in NXF format can also be downloaded via **Host Interface** by using the **cifX Driver Setup Utility** and the **NXPCA-PCI Adapter Board**. This is described in the *Downloading NXF Firmware via PCI and Host Interface* section on page 63.

Note that the Second Stage Bootloader (SSBL) must be downloaded and running on the NXHX board before you can download or boot any firmware in NXF format. The SSBL can be downloaded by the **netX Bootwizard** tool (see *Downloading Executable Binary Image to Serial Flash of the NXHX 51-ETM via USB* section on page 46).

3 Device Drawing and Positions of the NXHX 51-ETM

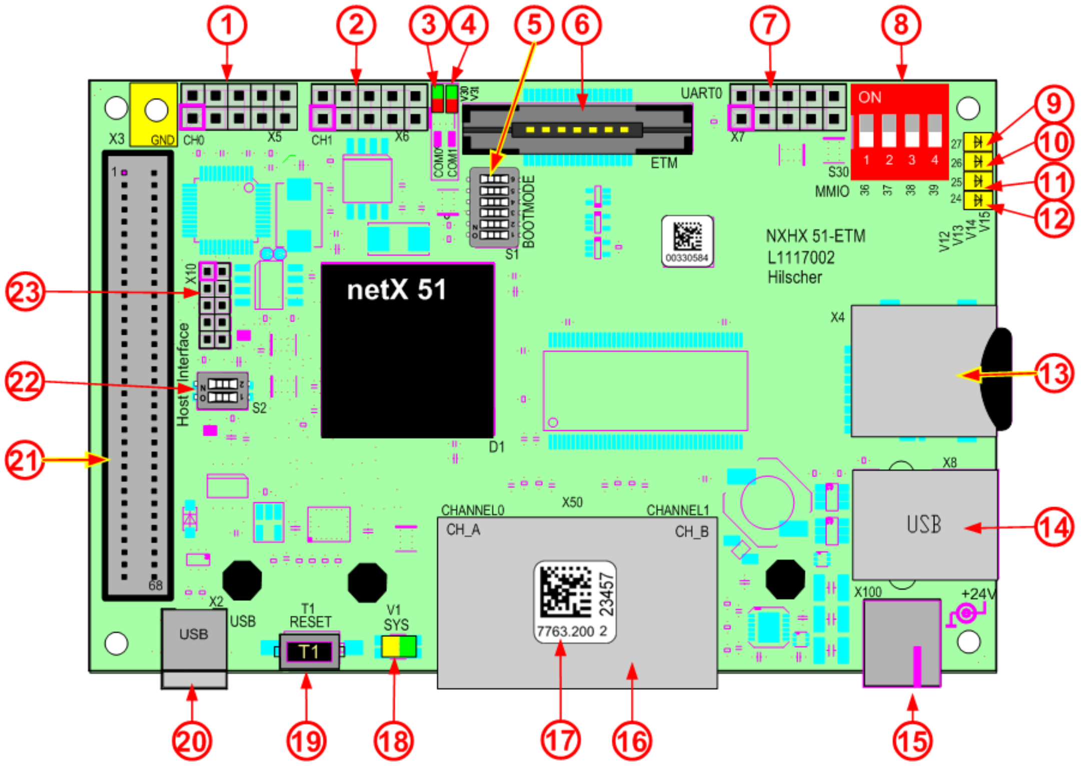


Figure 1: NXHX51-ETM Printed Circuit Board

No. in figure	Name	Description
①	X5	Fieldbus interface CH0
②	X6	Fieldbus interface CH1
③	V30	Communication status LED 0 (green / red)
④	V31	Communication status LED 1 (green / red)
⑤	S1	Boot strap options
⑥	X9	ETM-Interface netX 51
⑦	X7	UART0 interface
⑧	SW30	4 pol. DIL switch as general input
⑨	V15	LED yellow, MMIO27 as general output
⑩	V14	LED yellow, MMIO26 as general output
⑪	V13	LED yellow, MMIO25 as general output
⑫	V12	LED yellow, MMIO24 as general output
⑬	X4	microSD Card connector
⑭	X8	USB connector type B, HiTOP
⑮	X100	24 V power connector for board
⑯	X50	2 x RJ45 connector
⑰	-	Matrix label
⑱	V1	System status LED (yellow / green)
⑲	T1	Power on reset
⑳	X2	Mini-B USB connector
㉑	X3	Host interface

© Hilscher 2013

No. in figure	Name	Description
㉒	S2	Host interface mode
㉓	X10	Host interface configuration jumper

Table 2: List of Positions on Printed Circuit Board

4 Connecting Power Supply

The **NXHX 51-ETM** Development Board is powered by an external DC supply voltage of 24 V (±6V). Use the Hilscher **NXAC Power** adapter (part number 7930.000).

NOTICE

Device Destruction!

- Use only the permissible supply voltage of 24V DC (±6V) to operate the NXHX 51-ETM.
- Operating the NXHX 51-ETM with a supply voltage above the specified range leads to device destruction.

➢ Plug the barrel connector of the NXAC-POWER power supply into the power supply chassis socket on the NXHX board connector as shown in the picture below.

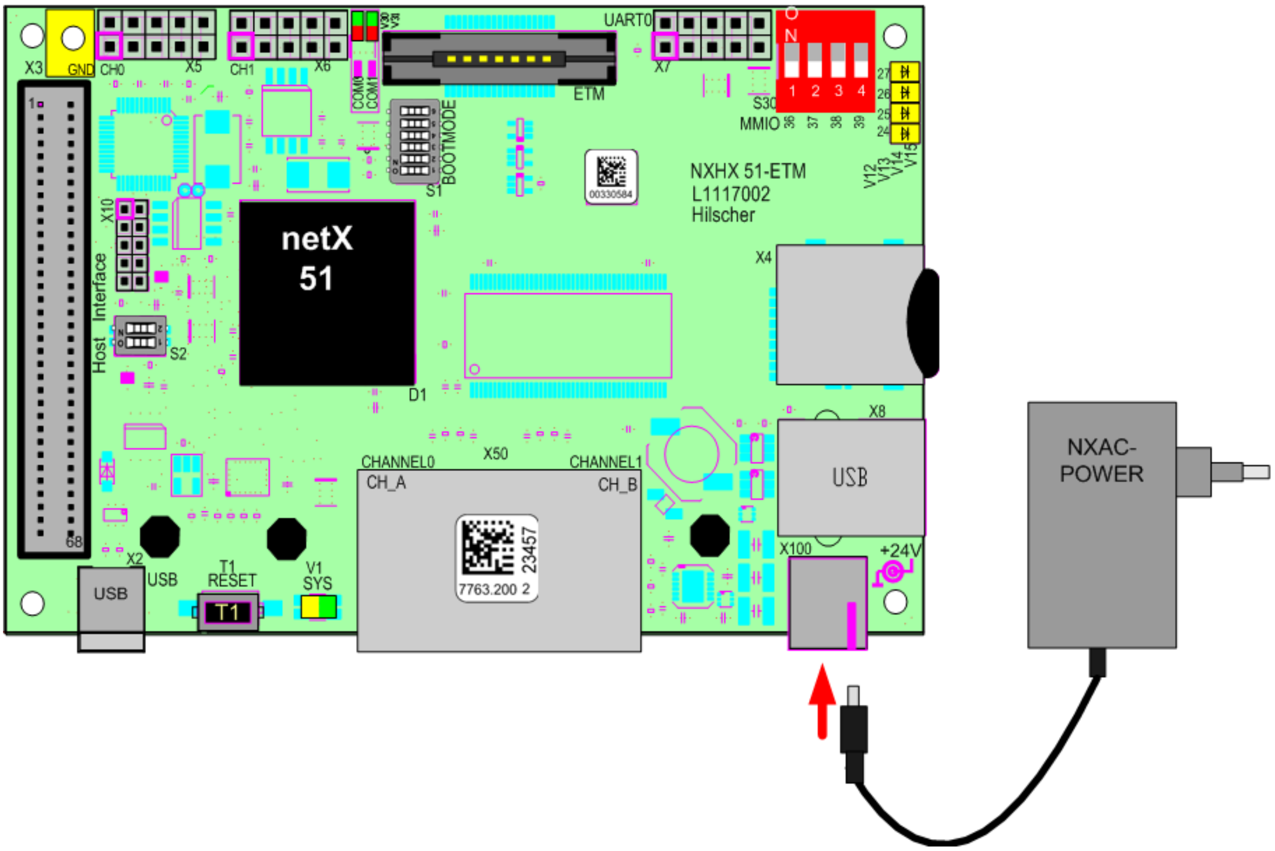


Figure 2: Connect Power Supply

5 Step-by-Step Instructions for Typical Use Cases

5.1 Installing Code Sourcery Compiler on Your Development PC

5.1.1 Overview

This section describes how to install the Mentor **Code Sourcery G++ Lite for ARM EABI** compiler on your development PC. Code Sourcery is used by the **Waf** build framework and the **HiTOP** IDE as tool for compiling the C source code provided on the product DVD.

5.1.2 Prerequisites

- NXHX 51-ETM Product DVD.
- You have access to the internet (for downloading Code Sourcery).

5.1.3 Step-by-Step Instructions

➢ Open `Software\Mentor - Codesourcery` directory on the product DVD.

➢ Double-click **arm-none-eabi.exe.lnk** to start downloading the Code Sourcery installation program from the internet.

➯ The web browser opens and asks for permission to download the Code Sourcery installation program.

➢ After download, double-click the downloaded **arm-2011.03-42-arm-none-eabi.exe** file to start the installation program on your PC.

➢ Follow the instruction of the installation program. Accept all suggested default settings.

5.2 Using Waf to Build ELF Files from All Application Examples

5.2.1 Overview

This section describes how to use Waf to build the **HAL**, **LOM**, **nonOS** and **rcX** application examples provided in the `Examples and API` folder of the product DVD at once.

5.2.2 Prerequisites

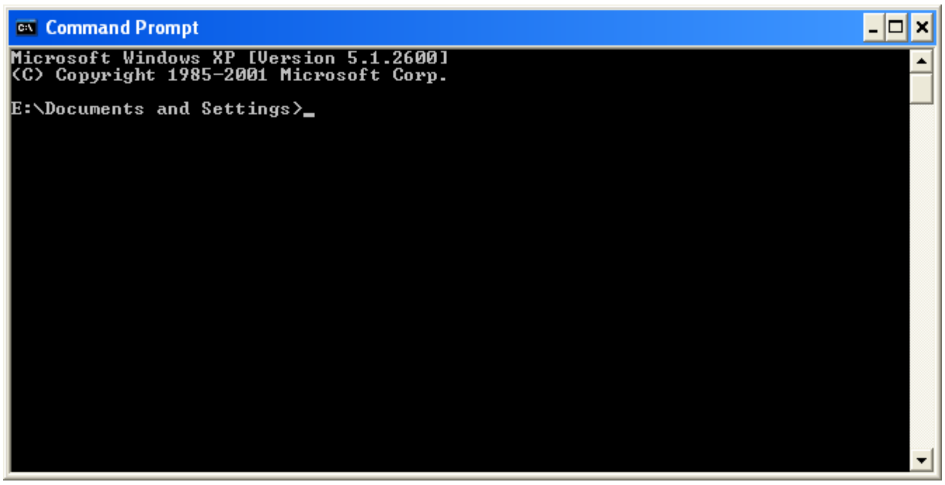
- You have installed **Code Sourcery G++ Lite for ARM EABI** on your development PC (see *Installing Code Sourcery Compiler on Your Development PC* section on page 19).
- You have copied the `Examples and API` folder from the product DVD to a local path on your development PC.

5.2.3 Step-by-Step Instructions

1. Open the command prompt on your development PC.

➢ In the Windows **Start** menu, choose **All Programs** > **Accessories** > **Command Prompt**.

➩ The **Command Prompt** opens:



```
Microsoft Windows XP [Version 5.1.2600]
(C) Copyright 1985-2001 Microsoft Corp.

E:\Documents and Settings>_
```

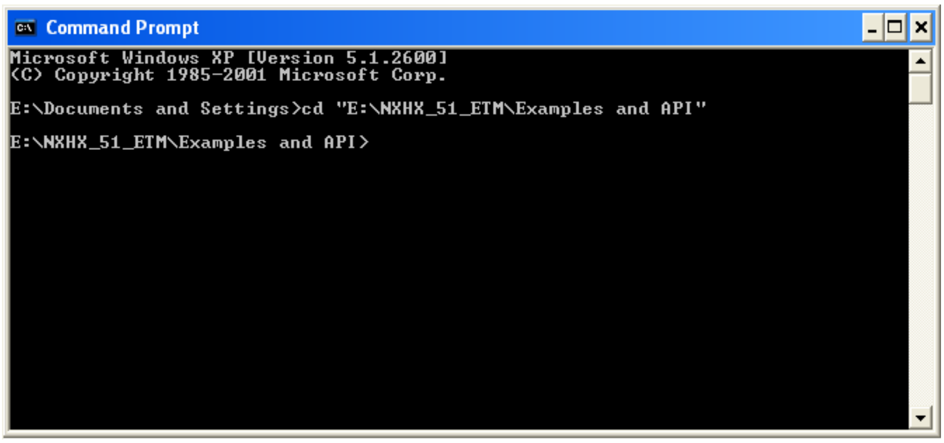
Figure 3: Command Prompt in Windows XP

2. Change to the directory where the **Examples and API** folder is stored.

➢ If you have stored the **Examples and API** folder e. g. in the directory `E:\NXHX_51_ETM` on your PC, change to the E drive (if necessary) and enter the following string:

```
cd "E:\NXHX_51_ETM\Examples and API"
```

➯ The prompt shows the specified path:

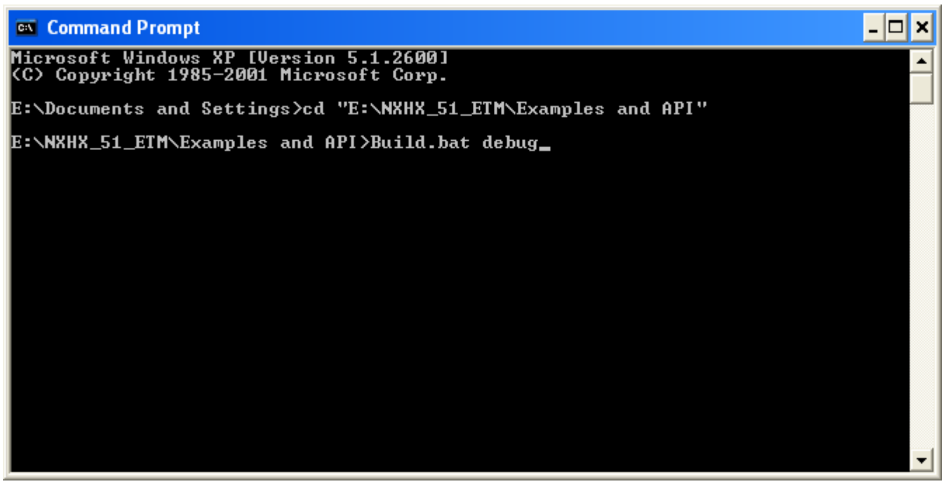


```
Microsoft Windows XP [Version 5.1.2600]
(C) Copyright 1985-2001 Microsoft Corp.

E:\Documents and Settings>cd "E:\NXHX_51_ETM\Examples and API"

E:\NXHX_51_ETM\Examples and API>
```

Figure 4: Change Directory in Command Prompt

3. Execute Build.bat batch file to start the building process.

➢ Enter **Build.bat** followed by the option **debug** or **release**.



```
Microsoft Windows XP [Version 5.1.2600]
(C) Copyright 1985-2001 Microsoft Corp.

E:\Documents and Settings>cd "E:\NXHX_51_ETM\Examples and API"

E:\NXHX_51_ETM\Examples and API>Build.bat debug_
```

Figure 5: Execute Build.bat

Note: If you later want to debug the produced ELF files with a debugger of your choice, use the **debug** option. If you don’t want to debug them, use the **release** option.

➯ Waf starts to build all application examples provided in the `Examples and API` folder (with the exception of the already built firmware file and the host application stored in the **LFW** folder). It creates a `build` directory and stores the ELF files and all produced output in the `debug` or `release` folder in the `build` directory according to the option you have specified.

5.3 Using Waf to Build an ELF File from an rcX Application Example

5.3.1 Overview

If you don't want to build all application examples at once (as described in the preceding section), you can use the Waf build option "`--target=`" to specify a certain single example that you want to build. This section describes how to use Waf to produce a single ELF file from the **rcX Tasks** application example provided in the `Examples and API\rcX\1. rcX Tasks` directory on the product DVD.

You can start the build process from a command prompt or from a customized **Build.bat** batch file; both methods are described in this section.

If you want to produce ELF files from different examples and for different purposes at different times (i. e. debugging or release), you can create separate customized **Build.bat** batch files for each target and purpose.

Note, that you have to specify the exact name of the application example that you want to build. How to find out the exact name of an application example is described in step 1 of these step-by-step instructions.

5.3.2 Prerequisites

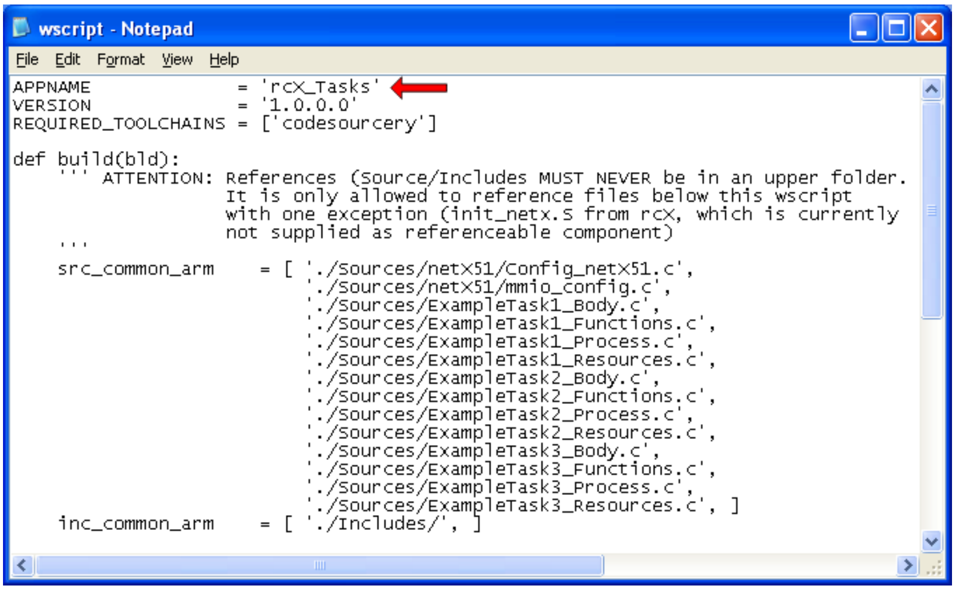
- You have installed **Code Sourcery G++ Lite for ARM EABI** on your development PC (see *Installing Code Sourcery Compiler on Your Development PC* section on page 19).
- You have copied the `Examples and API` folder from the product DVD to a local path on your development PC.

5.3.3 Step-by-Step Instructions

1. Find out the name of the application example which you want to build.

- ➢ Open the folder of the application example. In this case, it is the `Examples and API\rcX\1. rcX Tasks` folder.
- ➢ In the `1. rcX Tasks` folder, open the **wscript** file with an editor, e. g. **Notepad**.

➳ The application name is stated behind **APPNAME**.



```
APPNAME              = 'rcX_Tasks'
VERSION              = '1.0.0.0'
REQUIRED_TOOLCHAINS = ['codesourcery']

def build(bld):
    '''  ATTENTION: References (Source/Includes MUST NEVER be in an upper folder.
                    It is only allowed to reference files below this wscript
                    with one exception (init_netx.S from rcX, which is currently
                    not supplied as referenceable component)
    '''
    src_common_arm     = [ './Sources/netX51/Config_netX51.c',
                           './Sources/netX51/mmio_config.c',
                           './Sources/ExampleTask1_Body.c',
                           './Sources/ExampleTask1_Functions.c',
                           './Sources/ExampleTask1_Process.c',
                           './Sources/ExampleTask1_Resources.c',
                           './Sources/ExampleTask2_Body.c',
                           './Sources/ExampleTask2_Functions.c',
                           './Sources/ExampleTask2_Process.c',
                           './Sources/ExampleTask2_Resources.c',
                           './Sources/ExampleTask3_Body.c',
                           './Sources/ExampleTask3_Functions.c',
                           './Sources/ExampleTask3_Process.c',
                           './Sources/ExampleTask3_Resources.c', ]
    inc_common_arm     = [ './Includes/', ]
```

Figure 6: Opened wscript File

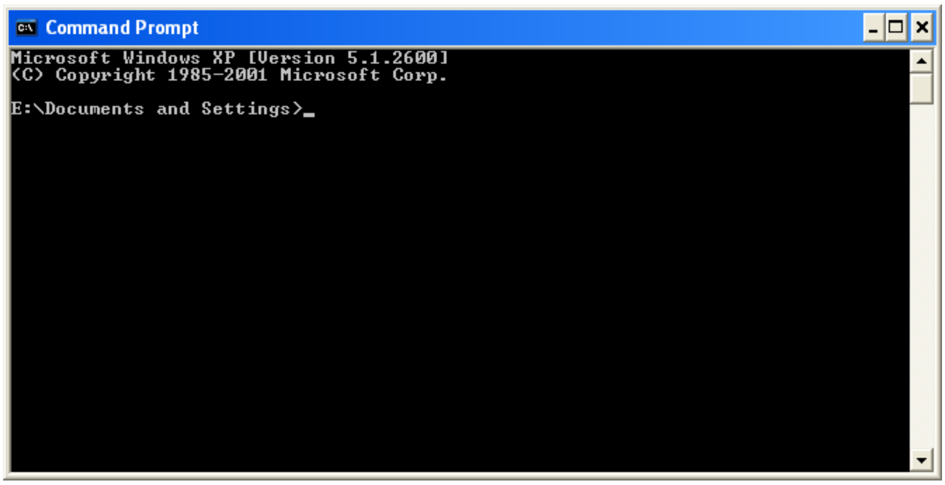
- ➢ Note or write down the application name on a sheet of paper.
- ➢ Close the **wscript** file.

Using Command Prompt:

2. Open the command prompt on your development PC.

- ➢ In the Windows **Start** menu, choose **All Programs** > **Accessories** > **Command Prompt**.

➳ The **Command Prompt** opens:



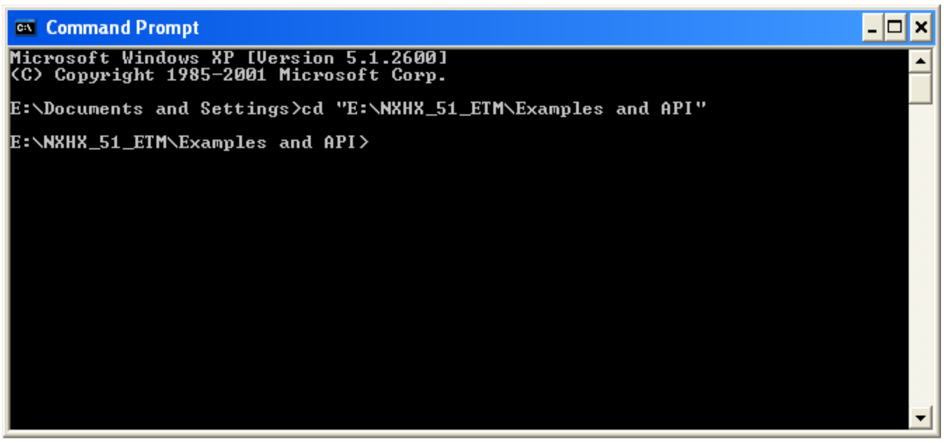
```
Microsoft Windows XP [Version 5.1.2600]
(C) Copyright 1985-2001 Microsoft Corp.

E:\Documents and Settings>_
```

Figure 7: Command Prompt in Windows XP

3. Change to the directory where the **Examples and API** folder is stored.

- ➢ If you have stored the **Examples and API** folder e. g. in the directory `E:\NXHX_51_ETM` on your PC, change to the E drive (if necessary) and enter the following string:
  `cd “E:\NXHX_51_ETM\Examples and API”`

➩ The prompt shows the specified path:



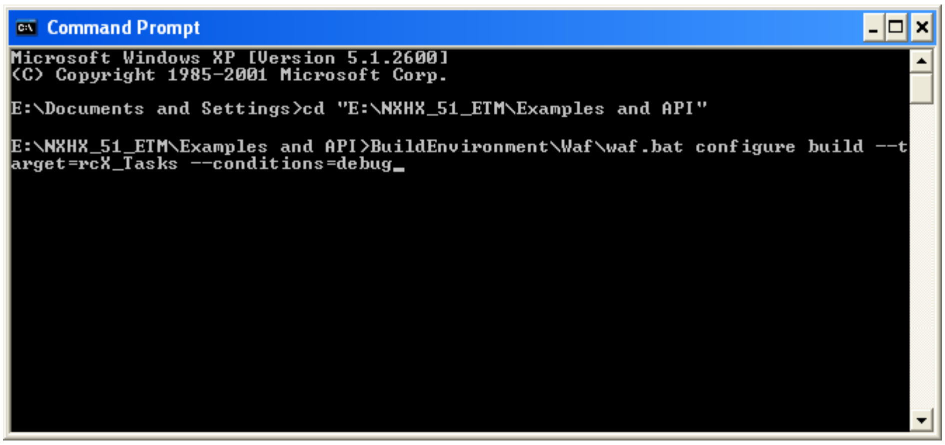
```
Microsoft Windows XP [Version 5.1.2600]
(C) Copyright 1985-2001 Microsoft Corp.

E:\Documents and Settings>cd "E:\NXHX_51_ETM\Examples and API"

E:\NXHX_51_ETM\Examples and API>
```

Figure 8: Change Directory in Command Prompt

4. Specify build options and execute waf.bat batch file.

➢ To build an ELF for debugging from the **rcX_Tasks** example, type in the following string behind the prompt, then press **Enter** key on your keyboard:

```
BuildEnvironment\Waf\waf.bat configure build --target=rcX_Tasks --conditions=debug
```



```
Microsoft Windows XP [Version 5.1.2600]
(C) Copyright 1985-2001 Microsoft Corp.

E:\Documents and Settings>cd "E:\NXHX_51_ETM\Examples and API"

E:\NXHX_51_ETM\Examples and API>BuildEnvironment\Waf\waf.bat configure build --t
arget=rcX_Tasks --conditions=debug_
```

Figure 9: Execute waf.bat with Target and Build Options

Note: If you want to build a different application (not the **rcX_Tasks** application), look up the APPNAME in the **wscript** file belonging to the corresponding application example and enter it behind the target option: `--target=[APPNAME]`. Note that the parameters are case sensitive.

If you want to use the ELF for debugging, don’t forget to add the **debug** option: `--conditions=debug`. If you don’t use the `--conditions=debug` option, the ELF will be built for **release** by default.

➩ Waf starts to build the application example specified by the target option (i. e. the **rcX_Tasks** example). It creates a `build\debug` or `build\release` directory and stores the produced ELF in the corresponding application example folder (i. e. in the `Examples and API\build\debug\rcX\1. rcX Tasks` directory).

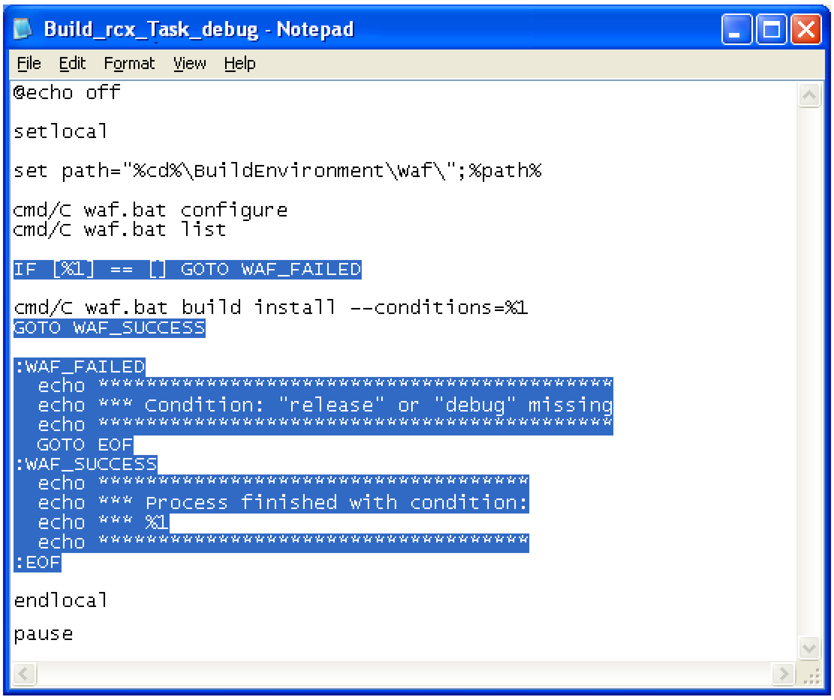
Using Customized Build.bat file:

2. Duplicate the **Build.bat** MS-DOS batch file.

- ➢ In the Windows Explorer, open the `Examples and API` folder on your development PC.
- ➢ Copy the **Build.bat** file and rename the copy according to its intended function. If, e. g., you want to use the batch file to build an ELF from the **rcX Tasks** application example for the purpose of debugging, you could name it **Build_rcx_Task_debug.bat**.

3. Edit batch file.

- ➢ Select your copy of the **Build.bat** file in the **Windows Explorer** and choose **Edit** from the context menu.
- ➪ The **Build.bat** file opens in **Notepad**.
- ➢ Delete obsolete code lines. The obsolete lines are highlighted in blue in the figure below:

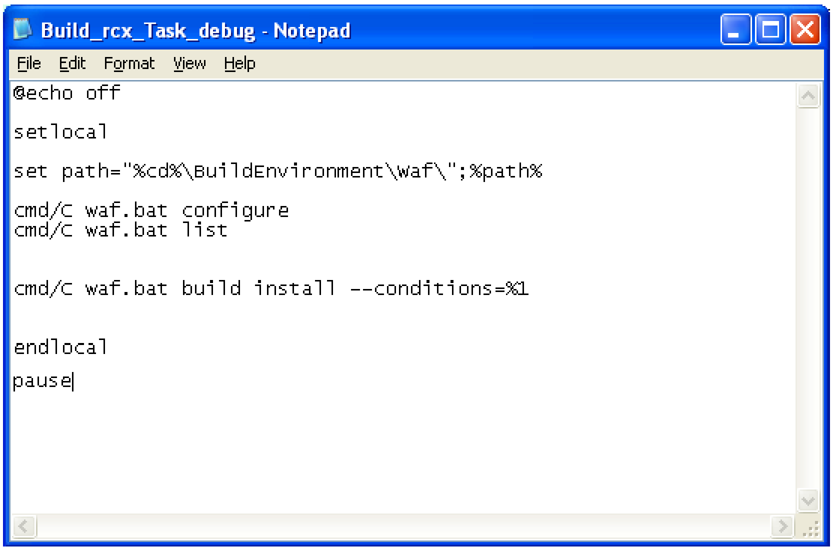


```
@echo off

setlocal

set path="%cd%\BuildEnvironment\Waf\";%path%

cmd/C waf.bat configure
cmd/C waf.bat list

IF [%1] == [] GOTO WAF_FAILED

cmd/C waf.bat build install --conditions=%1
GOTO WAF_SUCCESS

:WAF_FAILED
  echo *******************************************
  echo *** Condition: "release" or "debug" missing
  echo *******************************************
  GOTO EOF
:WAF_SUCCESS
  echo ************************************
  echo *** Process finished with condition:
  echo *** %1
  echo ************************************
:EOF

endlocal

pause
```

Figure 10: Delete Obsolete Commands in Build.bat File

Note: These code lines are obsolete, because in this method, the Build.bat will be started by double-click, not by using the Command Prompt.

➩ After deleting the obsolete lines, the file should now look like this:

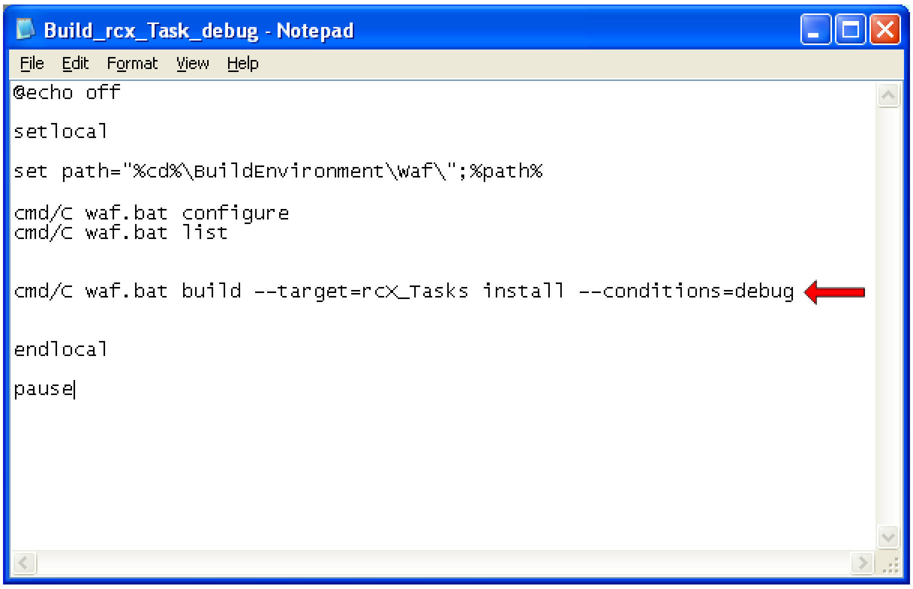


```
@echo off

setlocal

set path="%cd%\BuildEnvironment\waf\";%path%

cmd/C waf.bat configure
cmd/C waf.bat list


cmd/C waf.bat build install --conditions=%1


endlocal

pause
```

Figure 11: Build.bat File After Deleting Obsolete Commands

- ➢ Specify the build options at the position indicated in the figure below. In our example, use the following string:

```
cmd/C waf.bat build --target=rcX_Tasks install --conditions=debug
```



```
@echo off

setlocal

set path="%cd%\BuildEnvironment\waf\";%path%

cmd/C waf.bat configure
cmd/C waf.bat list


cmd/C waf.bat build --target=rcX_Tasks install --conditions=debug


endlocal

pause
```

Figure 12: Edited Build.bat File

Note: The parameters are case sensitive, therefore mind the upper-case “X” in “rcX_Tasks”.

If you want to build a different application (not the **rcX_Tasks** application example), look up the APPNAME in the **wscript** file belonging to the application example and enter the name behind the target option: `--target=[APPNAME]`.

Don’t forget to enter the `--conditions=debug` option if you want to use the ELF for debugging. If you want to use the ELF not for debugging but for release, enter `--conditions=release` option instead.

- ➢ Save and close the **Build.bat** file after editing.

4. Execute batch file.

- ➢ Double-click your edited copy of the **Build.bat** file.
- ➯ Waf starts to build the application example (i. e. the **rcX_Tasks** example) according to the options specified in the batch file. It creates a `build\debug` or `build\release` directory and stores the produced ELF in the corresponding application example folder (in our example, this will be in the `Examples and API\build\debug\rcX\1. rcX Tasks` directory).

5.4 Using HiTOP to Build, Download and Debug an ELF File Made from an rcX Application Example

5.4.1 Overview

This section describes how to use HiTOP to build, download and debug an ELF file containing the c source code of the rcX UART example provided in the `Examples and API\rcX\7. rcX UART` folder on the NXHX 51-ETM product DVD. This section should give you a basic understanding of how to use the NXHX board together with HiTOP and the example code provided on the product DVD. Detailed instructions about the HiTOP debugger are not provided here, please refer to the HiTOP online help for information about debugging with HiTOP.

5.4.2 Prerequisites

- You have installed **Code Sourcery G++ Lite for ARM EABI** on your development PC (see *Installing Code Sourcery Compiler on Your Development PC* section on page 19).
- The NXHX board is connected to a voltage supply.
- The serial flash memory of the NXHX 51-ETM board should be empty. (If you have already downloaded any file to the serial flash, we recommend using the Bootwizard application to erase it before you download and debug the ELF. Instructions for this are provided in the *netX Bootwizard* manual.)
- You have a USB cable with a Type B connector ready.
- You have a NXHX-RS232 adapter (Hilscher part number 7923.010) and a NULL modem cable ready (for testing the UART function of the downloaded ELF containing the rcX example).
- You have access to the NXHX 51-ETM product DVD.
- You have copied the `Examples and API` folder from the product DVD to a local path on your development PC.

5.4.3 Step-by-Step Instructions

1. Create an Environment Variable for Code Sourcery in Windows.

If you are using Windows XP:

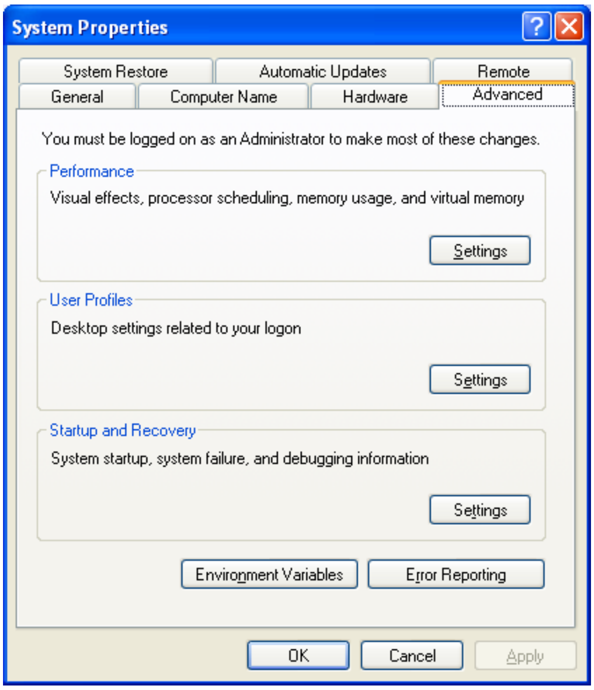
➢ In the **Start menu,** choose **Control Panel** entry.

➩ The **Control Panel** window opens.

➢ In the **Control Panel**, double-click on **System** entry.

➩ The **System Properties** sheet opens.

➢ In the **System Properties** sheet, select **Advanced** tab.



You must be logged on as an Administrator to make most of these changes.

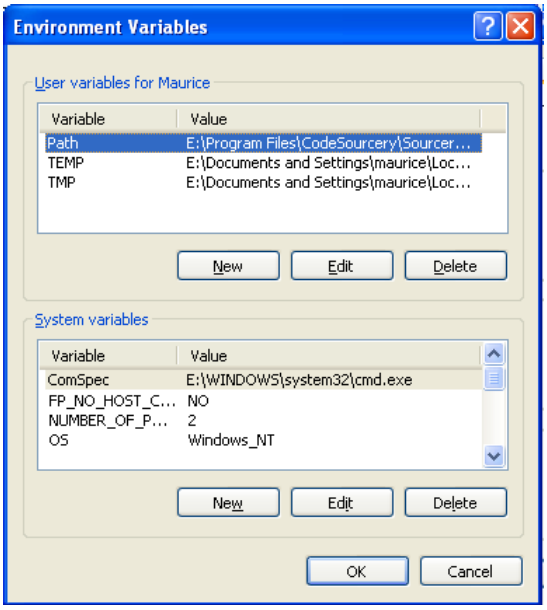
Visual effects, processor scheduling, memory usage, and virtual memory

Desktop settings related to your logon

System startup, system failure, and debugging information

Figure 13: System Properties in Windows XP

- ➢ In the **Advanced** tab, click **Environment Variables** button.
- ➯ The **Environment Variables** sheet opens:



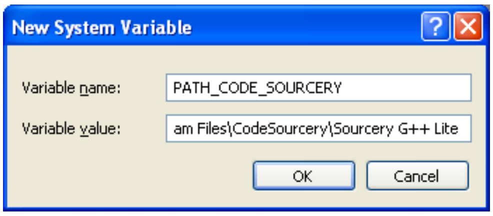
Variable	Value
Path	E:\Program Files\CodeSourcery\Sourcer…
TEMP	E:\Documents and Settings\maurice\Loc…
TMP	E:\Documents and Settings\maurice\Loc…

Variable	Value
ComSpec	E:\WINDOWS\system32\cmd.exe
FP_NO_HOST_C…	NO
NUMBER_OF_P…	2
OS	Windows_NT

Figure 14: Environment Variables in Windows XP

- ➢ In the **System variables** area, click **New** button.

➩ The **New System Variable dialog window** opens:



Variable name: PATH_CODE_SOURCERY

Variable value: am Files\CodeSourcery\Sourcery G++ Lite

Figure 15: New System Variable in Windows XP

➢ In the **Variable name** field, enter **PATH_CODE_SOURCERY** string. In the **Variable value** field, enter the path to the Code Sourcery installation on your local PC, e. g. `C:\Program Files\CodeSourcery\Sourcery G++ Lite`.

➢ Close all opened sheets with **OK**.

If you are using Windows 7 or 8:

➢ In the **Start menu,** choose **Control Panel** entry.

➩ The **Control Panel** window opens.

➢ In the **Control Panel**, click on **System and Security** entry.

➩ The **System and Security** sheet opens:

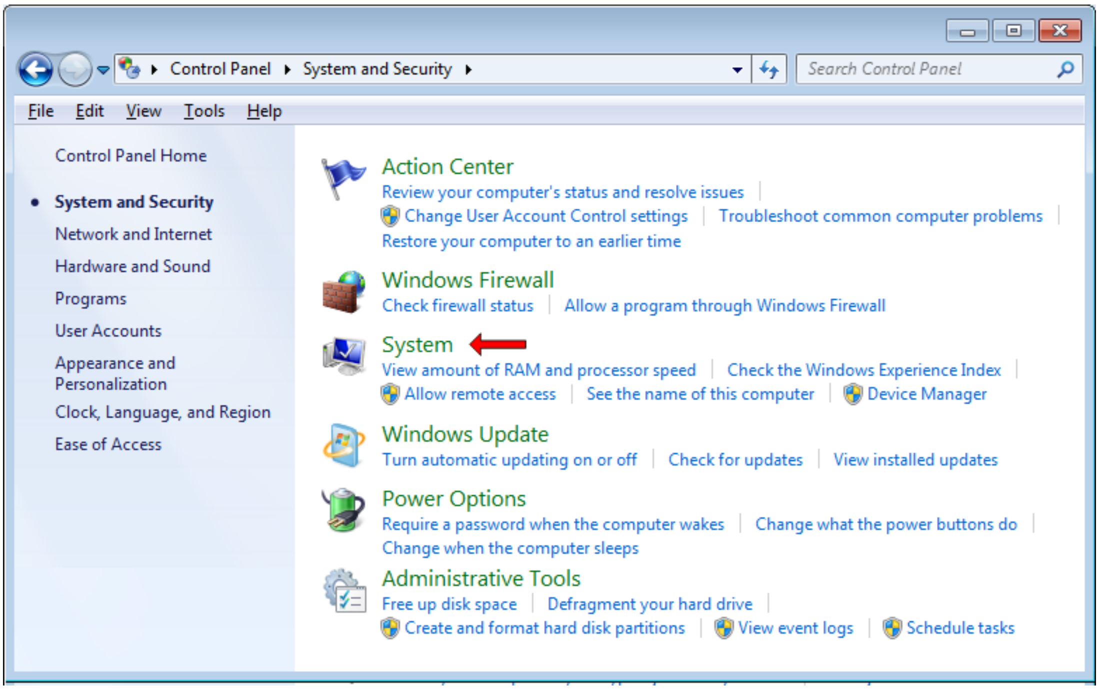
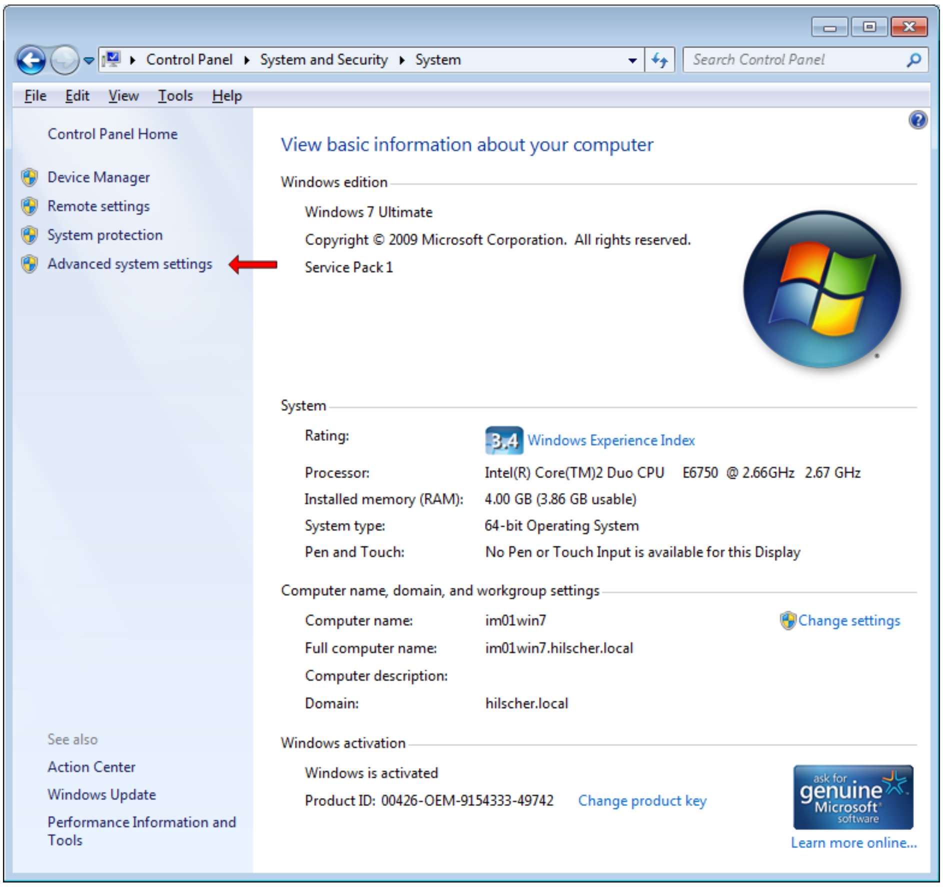

Control Panel ▸ System and Security ▸
Search Control Panel
File Edit View Tools Help
Control Panel Home
System and Security
Network and Internet
Hardware and Sound
Programs
User Accounts
Appearance and Personalization
Clock, Language, and Region
Ease of Access
Action Center
Review your computer's status and resolve issues
Change User Account Control settings
Troubleshoot common computer problems
Restore your computer to an earlier time
Windows Firewall
Check firewall status
Allow a program through Windows Firewall
System
View amount of RAM and processor speed
Check the Windows Experience Index
Allow remote access
See the name of this computer
Device Manager
Windows Update
Turn automatic updating on or off
Check for updates
View installed updates
Power Options
Require a password when the computer wakes
Change what the power buttons do
Change when the computer sleeps
Administrative Tools
Free up disk space
Defragment your hard drive
Create and format hard disk partitions
View event logs
Schedule tasks

Figure 16: System and Security Sheet in Windows 7

➢ In the **System and Security** sheet, click **System** entry.

➮ The **System** sheet opens:



Control Panel ▸ System and Security ▸ System

Search Control Panel

File Edit View Tools Help

Control Panel Home

Device Manager

Remote settings

System protection

Advanced system settings

View basic information about your computer

Windows edition

Windows 7 Ultimate

Copyright © 2009 Microsoft Corporation. All rights reserved.

Service Pack 1

System

Rating:	3,4 Windows Experience Index
Processor:	Intel(R) Core(TM)2 Duo CPU E6750 @ 2.66GHz 2.67 GHz
Installed memory (RAM):	4.00 GB (3.86 GB usable)
System type:	64-bit Operating System
Pen and Touch:	No Pen or Touch Input is available for this Display

Computer name, domain, and workgroup settings

Computer name:	im01win7
Full computer name:	im01win7.hilscher.local
Computer description:	
Domain:	hilscher.local

Change settings

Windows activation

Windows is activated

Product ID: 00426-OEM-9154333-49742 Change product key

See also

Action Center

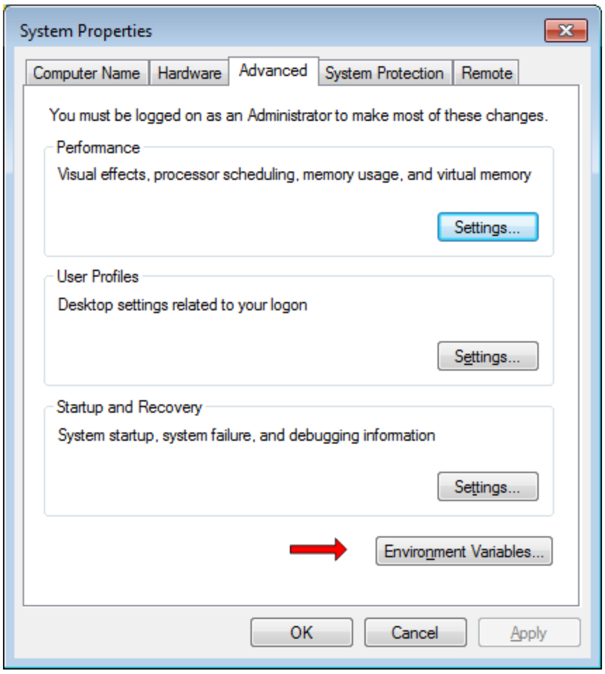
Windows Update

Performance Information and Tools

Figure 17: System Sheet in Windows 7

➢ In the **System** sheet, click **Advanced system settings** entry.

➮ The **Advanced** tab of the **System Properties** sheet opens:



System Properties

Computer Name | Hardware | Advanced | System Protection | Remote

You must be logged on as an Administrator to make most of these changes.

Performance

Visual effects, processor scheduling, memory usage, and virtual memory

Settings...

User Profiles

Desktop settings related to your logon

Settings...

Startup and Recovery

System startup, system failure, and debugging information

Settings...

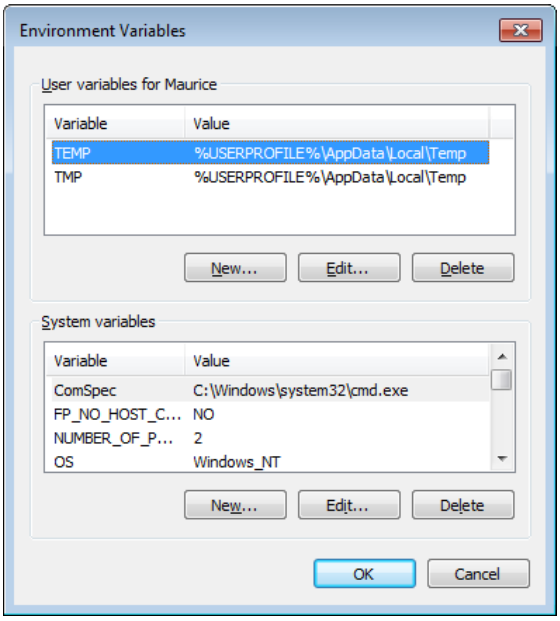
Environment Variables...

OK Cancel Apply

Figure 18: Advanced System Properties in Windows 7

➢ In the **Advanced** tab of the **System Properties** sheet, click **Environment Variables** button.

➪ The **Environment Variables** sheet opens:



Environment Variables

User variables for Maurice

Variable	Value
TEMP	%USERPROFILE%\AppData\Local\Temp
TMP	%USERPROFILE%\AppData\Local\Temp

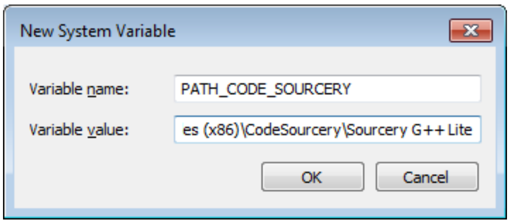
System variables

Variable	Value
ComSpec	C:\Windows\system32\cmd.exe
FP_NO_HOST_C...	NO
NUMBER_OF_P...	2
OS	Windows_NT

Figure 19: Environment Variables in Windows 7

➢ In the **System variables** area, click **New** button.

➪ The **New System Variable dialog window** opens:



New System Variable

Variable name: PATH_CODE_SOURCERY

Variable value: es (x86)\CodeSourcery\Sourcery G++ Lite

Figure 20: New System Variable in Windows 7

➢ In the **Variable name** field, enter **PATH_CODE_SOURCERY** string. In the **Variable value** field, enter the path to the Code Sourcery installation on your local PC, e. g. `C:\Program Files(x86)\CodeSourcery\Sourcery G++ Lite`.

➢ Close all opened windows with **OK**.

2. Install HiTOP Debugger on your development PC.

➢ Open `Software\Hitex` directory on the product DVD.

➢ Double-click **Hitop-NetX_5-40-xxxx.exe** to start the installation program.

➯ The **HiTOP for netSTICK** installation program starts.

➢ Follow the instruction of the installation program. Accept all suggested default settings.

3. Connect the Onboard USB HiTOP debugger to the Development PC.

➢ Connect the NXHX board to a voltage supply (for details, see *Connecting Power Supply* chapter on page 18).

➢ Plug an USB connector (type B) into the socket of the Onboard USB HiTOP debugger on the NXHX board (see position ⑭ in *Device Drawing and Positions of the NXHX 51-ETM* section on page 16) and connect the USB cable to your PC.

Note: The USB drivers needed for connecting the HiTOP debugger with the NXHX board have automatically been installed on your PC by the HiTOP installation program. However, under **Windows XP**, the installation process of the USB drivers needs to be completed in the **Found New Hardware Wizard**, which opens when you connect the NXHX board for the first time to your PC. For finishing the installation of the USB drivers in the wizard, follow the instructions given below. The **Found New Hardware Wizard** opens three times: for the **Hitex USB Serial JTAG** driver, for the **Hilscher USB Serial COM Port** driver and for the **Hilscher USB Serial Port**.

Under **Windows 7** and **8**, the **Installing device driver software** message appears in the Windows task bar when you connect the NXHX board to the PC via USB cable for the first time. Windows then automatically copies the driver files to the appropriate Windows directories, you do not need to take any action in this.

If you are using Windows XP:

➢ In the start screen of the **Found New Hardware Wizard**, answer the question **Can Windows connect to Windows Update…?** by selecting the **No, not this time** option.

➢ Click **Next** button.

➢ In the next screen, answer the question **What do you want the wizard to do?** by selecting **Install the software automatically** option.

➢ Click **Next**.

➯ Windows then copies the driver files to the Windows directories.

➢ In the **Completing the Found New Hardware Wizard** screen, click **Finish** button.

4. Establish UART connection.

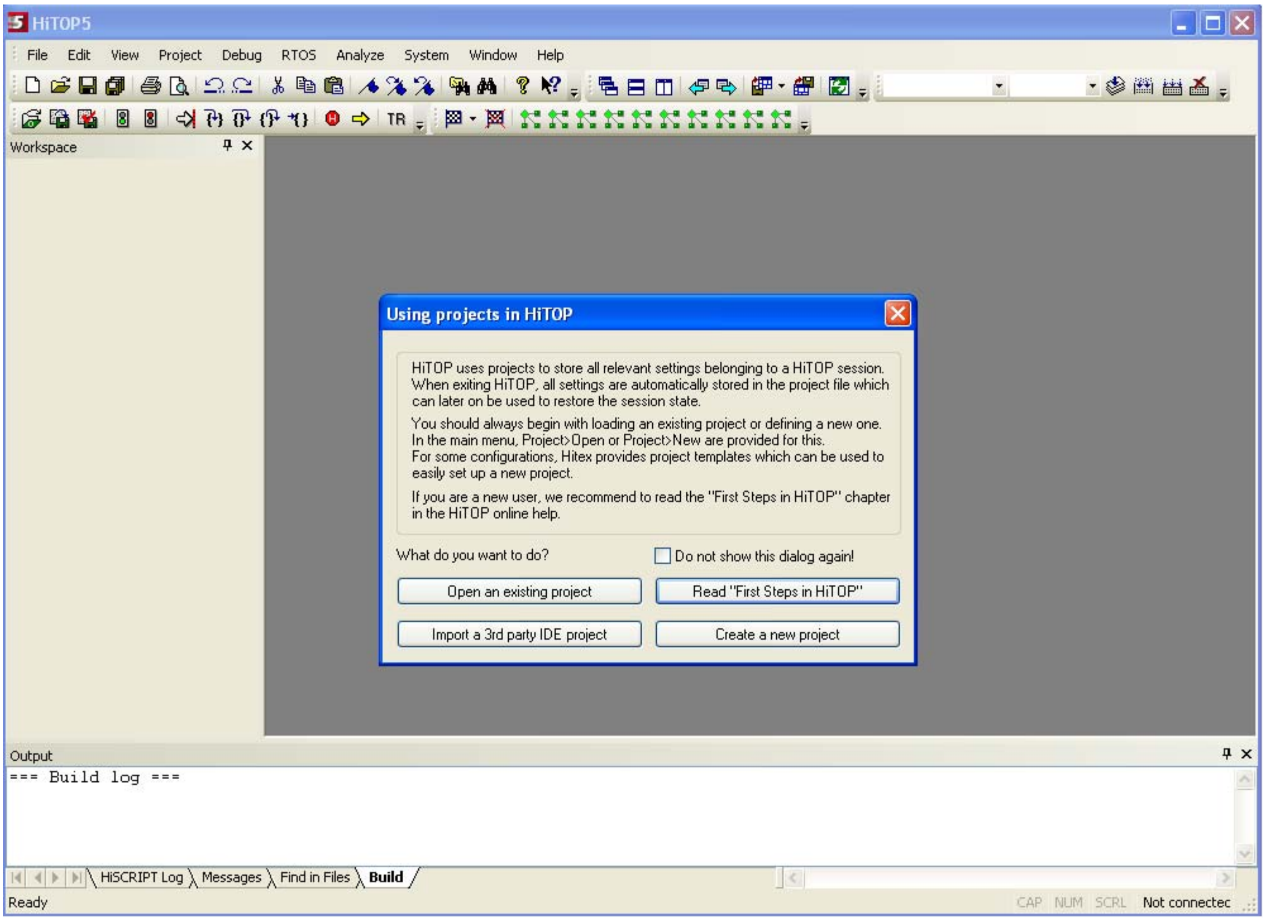
➢ Connect the NXHX-RS232 adapter to the UART0 interface of the NXHX board (see position ⑦ in *Device Drawing and Positions of the NXHX 51-ETM* chapter on page 16).

➢ Connect a NULL modem cable to the D-sub male plug on the NXHX-RS232 adapter. Connect the other end of the cable to the COM port of your development PC.

5. Adjust tool settings in HiTOP.

➢ In the Windows **Start** menu, choose **All Programs** > **HiTOP54-netSTICK** > **HiTOP Debugger**.

➪ HiTOP5 opens and displays the **Using projects in HiTOP** dialog window:


HiTOP5
File Edit View Project Debug RTOS Analyze System Window Help
Workspace
Output
HiSCRIPT Log
Messages
Find in Files
Build
Ready
CAP NUM SCRL Not connectec

Using projects in HiTOP

HiTOP uses projects to store all relevant settings belonging to a HiTOP session. When exiting HiTOP, all settings are automatically stored in the project file which can later on be used to restore the session state.

You should always begin with loading an existing project or defining a new one. In the main menu, Project>Open or Project>New are provided for this. For some configurations, Hitex provides project templates which can be used to easily set up a new project.

If you are a new user, we recommend to read the "First Steps in HiTOP" chapter in the HiTOP online help.

What do you want to do?

□ Do not show this dialog again!

Open an existing project | Read "First Steps in HiTOP"

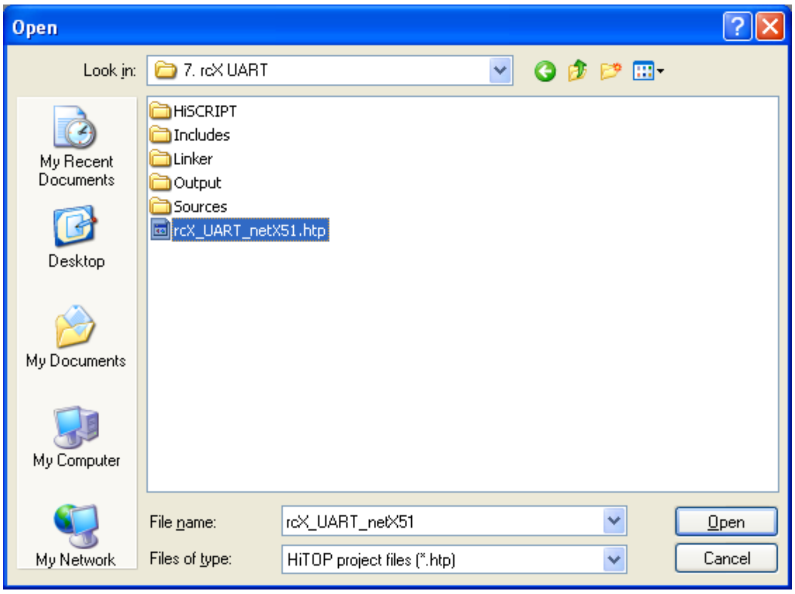
Import a 3rd party IDE project | Create a new project

```
=== Build log ===
```

Figure 21: HiTOP Start

➢ Click **Open an existing project** button.

➪ The **Open** dialog window opens:



Look in: 7. rcX UART

HiSCRIPT
Includes
Linker
Output
Sources
rcX_UART_netX51.htp

File name: rcX_UART_netX51

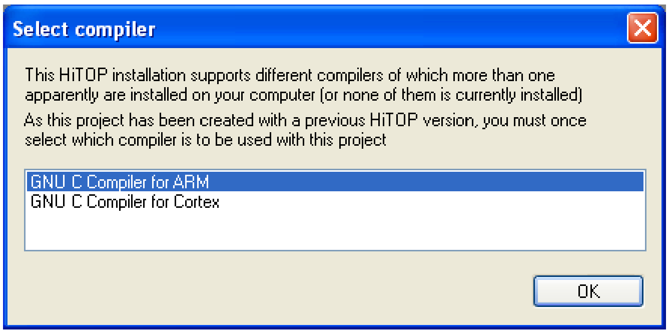
Files of type: HiTOP project files (*.htp)

Figure 22: Select Project File Dialog

➢ Navigate to the `Examples and API\rcX\7. rcX UART` folder.

➢ Select the **rcX_UART_netX51.htp** file, then click **Open** button.

➪ The **Select compiler** dialog window opens:



This HiTOP installation supports different compilers of which more than one apparently are installed on your computer (or none of them is currently installed)

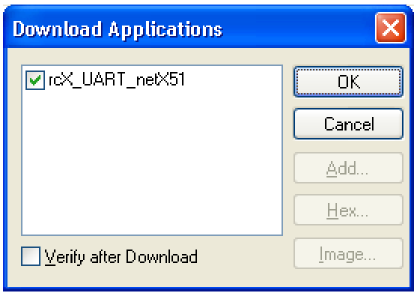
As this project has been created with a previous HiTOP version, you must once select which compiler is to be used with this project

GNU C Compiler for ARM
GNU C Compiler for Cortex

Figure 23: Select Compiler Dialog

➢ Select the **GNU C Compiler for ARM**, then click **OK** button.

➪ The **Download Applications** dialog window opens:



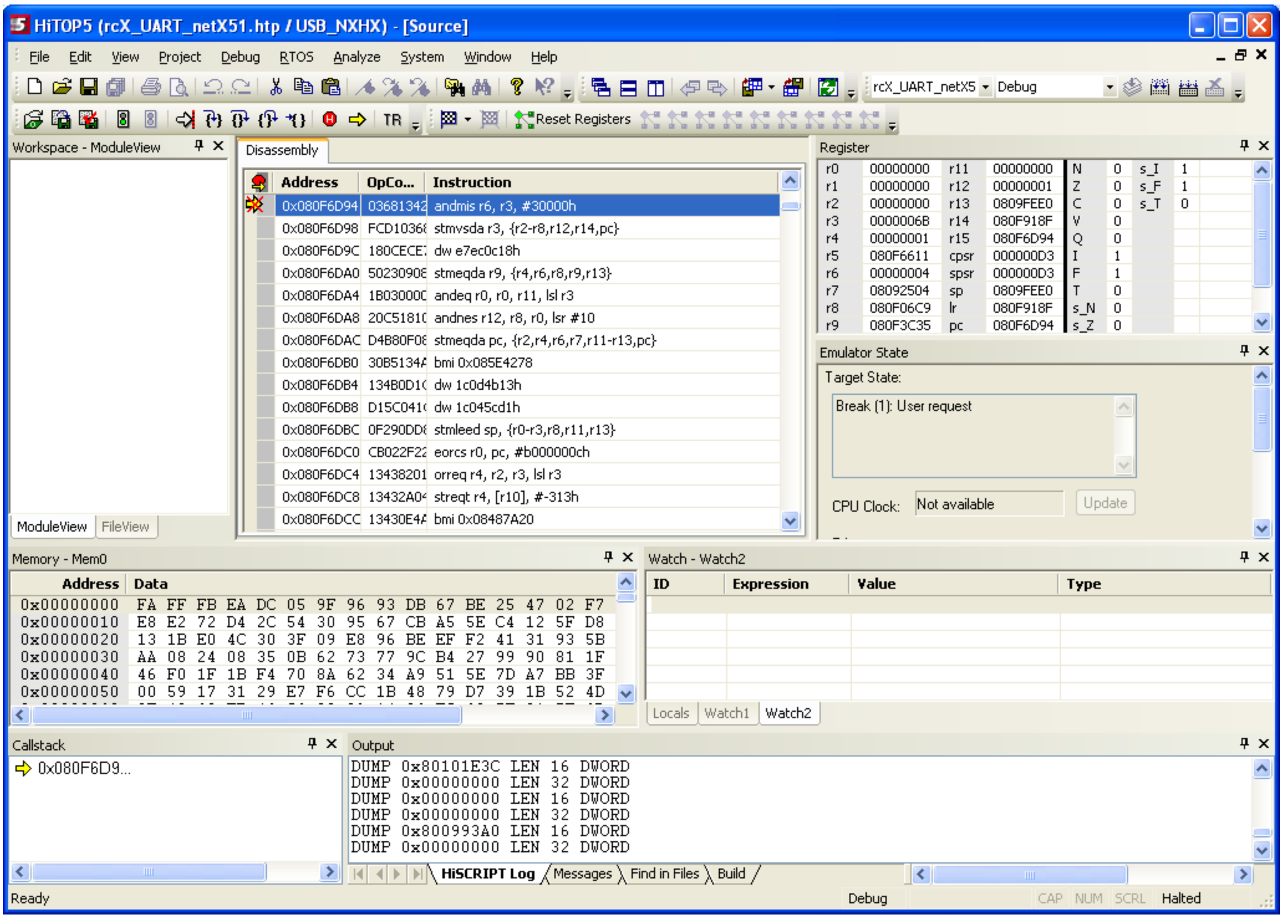
☑ rcX_UART_netX51

□ Verify after Download

Figure 24: Select Compiler Dialog

➢ Click **Cancel** button (you don't want to download the application yet, you first need to adjust the tool settings and build the application).

➯ The project is loaded and displayed in HiTOP:



HiTOP5 (rcX_UART_netX51.htp / USB_NXHX) - [Source]

Disassembly

Address	OpCo...	Instruction
0x080F6D94	03681342	andmis r6, r3, #30000h
0x080F6D98	FCD1036ŧ	stmvsda r3, {r2-r8,r12,r14,pc}
0x080F6D9C	180CECE:	dw e7ec0c18h
0x080F6DA0	5023090ŧ	stmeqda r9, {r4,r6,r8,r9,r13}
0x080F6DA4	1B03000C	andeq r0, r0, r11, lsl r3
0x080F6DA8	20C5181C	andnes r12, r8, r0, lsr #10
0x080F6DAC	D4B80F0ŧ	stmeqda pc, {r2,r4,r6,r7,r11-r13,pc}
0x080F6DB0	30B5134A	bmi 0x085E4278
0x080F6DB4	134B0D1(	dw 1c0d4b13h
0x080F6DB8	D15C041(	dw 1c045cd1h
0x080F6DBC	0F290DDŧ	stmleed sp, {r0-r3,r8,r11,r13}
0x080F6DC0	CB022F22	eorcs r0, pc, #b000000ch
0x080F6DC4	13438201	orreq r4, r2, r3, lsl r3
0x080F6DC8	13432A04	streqt r4, [r10], #-313h
0x080F6DCC	13430E4A	bmi 0x08487A20

Register

r0	00000000	r11	00000000	N	0	s_I	1
r1	00000000	r12	00000001	Z	0	s_F	1
r2	00000000	r13	0809FEE0	C	0	s_T	0
r3	0000006B	r14	080F918F	V	0		
r4	00000001	r15	080F6D94	Q	0		
r5	080F6611	cpsr	000000D3	I	1		
r6	00000004	spsr	000000D3	F	1		
r7	08092504	sp	0809FEE0	T	0		
r8	080F06C9	lr	080F918F	s_N	0		
r9	080F3C35	pc	080F6D94	s_Z	0		

Emulator State

Target State: Break (1): User request

CPU Clock: Not available Update

Memory - Mem0

```
  Address  Data
0x00000000 FA FF FB EA DC 05 9F 96 93 DB 67 BE 25 47 02 F7
0x00000010 E8 E2 72 D4 2C 54 30 95 67 CB A5 5E C4 12 5F D8
0x00000020 13 1B E0 4C 30 3F 09 E8 96 BE EF F2 41 31 93 5B
0x00000030 AA 08 24 08 35 0B 62 73 77 9C B4 27 99 90 81 1F
0x00000040 46 F0 1F 1B F4 70 8A 62 34 A9 51 5E 7D A7 BB 3F
0x00000050 00 59 17 31 29 E7 F6 CC 1B 48 79 D7 39 1B 52 4D
```

Watch - Watch2

ID	Expression	Value	Type

Callstack

0x080F6D9...

Output

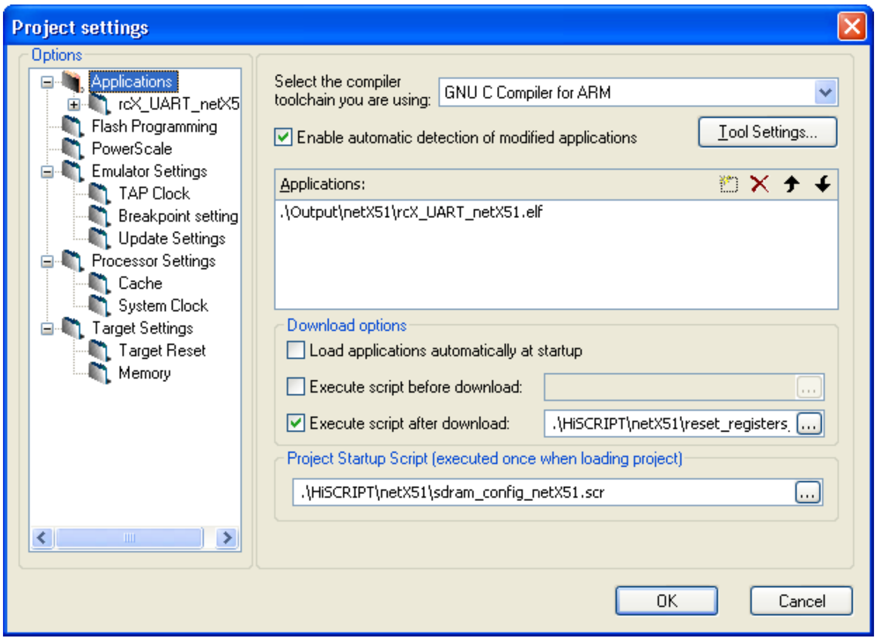
```
DUMP 0x80101E3C LEN 16 DWORD
DUMP 0x00000000 LEN 32 DWORD
DUMP 0x00000000 LEN 16 DWORD
DUMP 0x00000000 LEN 32 DWORD
DUMP 0x800993A0 LEN 16 DWORD
DUMP 0x00000000 LEN 32 DWORD
```

Ready Debug CAP NUM SCRL Halted

Figure 25: Project in HiTOP

➢ In the menu, choose **Project** > **Settings…**

➯ The **Project settings** dialog window opens:



Project settings

Options

- Applications
  - rcX_UART_netX5
- Flash Programming
- PowerScale
- Emulator Settings
  - TAP Clock
  - Breakpoint setting
  - Update Settings
- Processor Settings
  - Cache
  - System Clock
- Target Settings
  - Target Reset
  - Memory

Select the compiler toolchain you are using: GNU C Compiler for ARM

☑ Enable automatic detection of modified applications Tool Settings...

Applications:

.\Output\netX51\rcX_UART_netX51.elf

Download options

☐ Load applications automatically at startup

☐ Execute script before download:

☑ Execute script after download: .\HiSCRIPT\netX51\reset_registers

Project Startup Script (executed once when loading project)

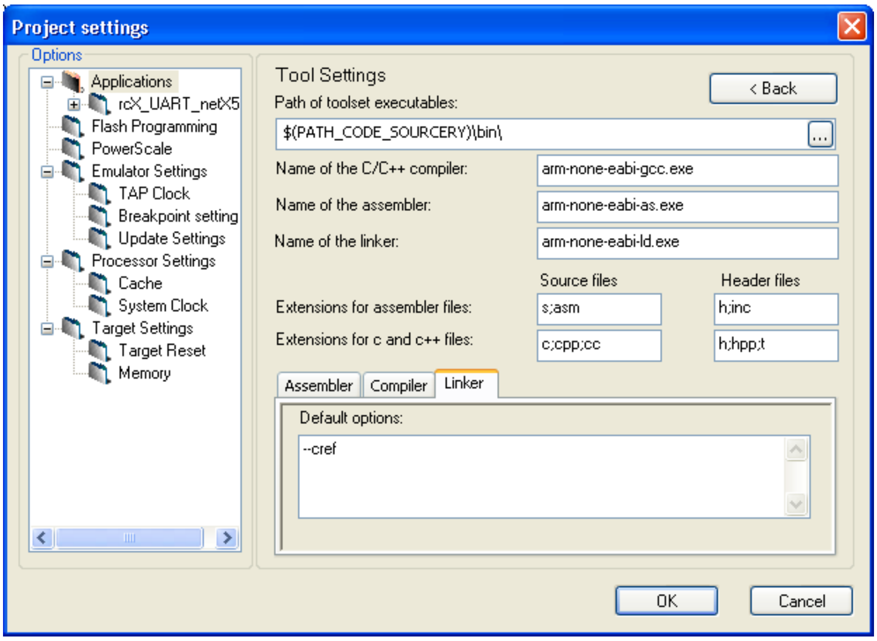
.\HiSCRIPT\netX51\sdram_config_netX51.scr

Figure 26: Project Settings

➢ Click **Tool Settings…** button.

➯ The **Tool Settings** dialog opens.

➢ Enter the parameters as shown below:



Tool Settings

Path of toolset executables: $(PATH_CODE_SOURCERY)\bin\

Name of the C/C++ compiler: arm-none-eabi-gcc.exe

Name of the assembler: arm-none-eabi-as.exe

Name of the linker: arm-none-eabi-ld.exe

	Source files	Header files
Extensions for assembler files:	s;asm	h;inc
Extensions for c and c++ files:	c;cpp;cc	h;hpp;t

Default options: --cref

Figure 27: Tool Settings

➢ Click **OK** button.

➯ You have adjusted the Tool Settings in HiTOP.

➢ Exit HiTOP.

6. Build and download netX UART example.

➢ Restart HiTOP.

➯ HiTOP opens and displays the **Using projects in HiTOP** dialog window.

➢ Choose **Open an existing project** option.

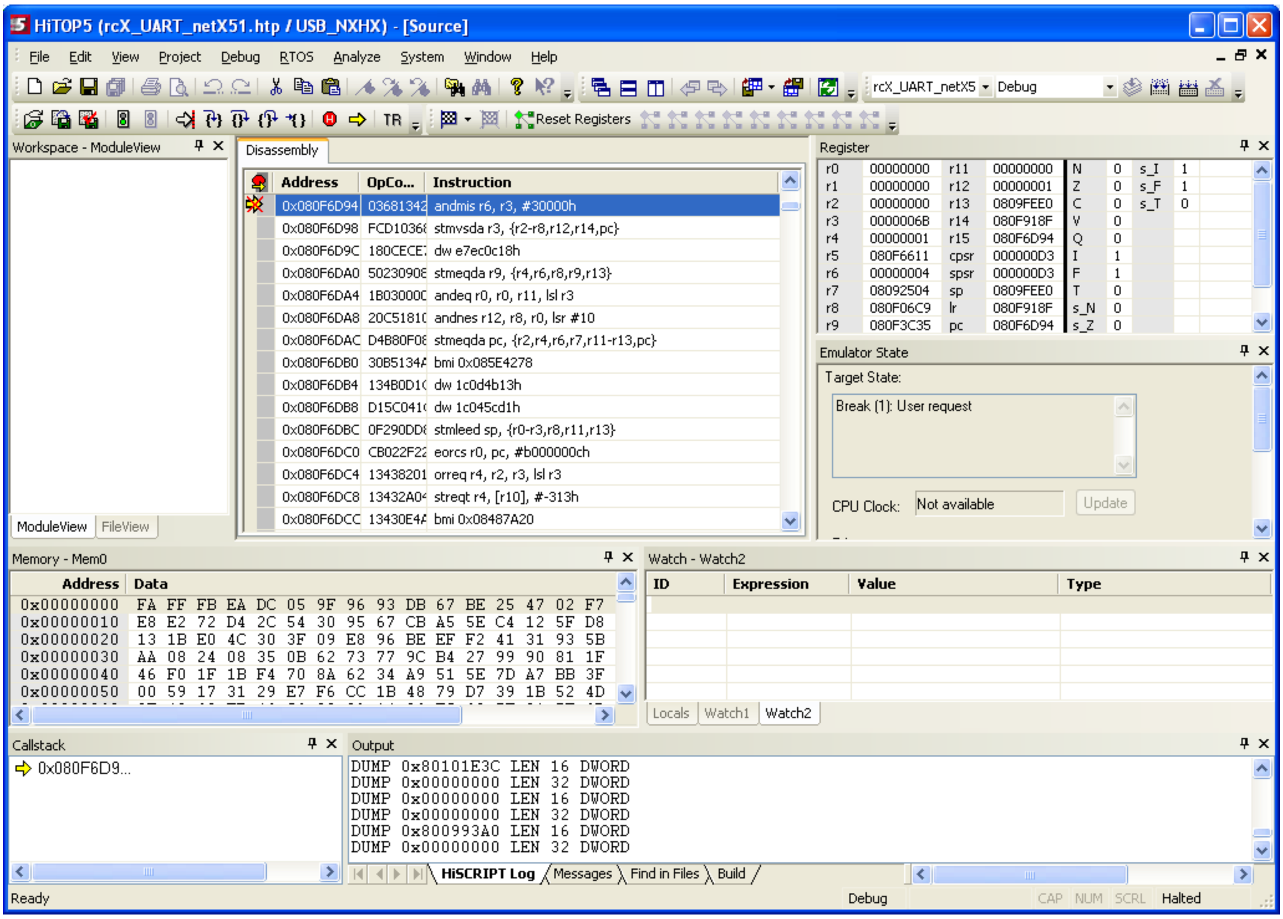
➯ The **Open** dialog window opens.

➢ Navigate to `Examples and API\rcX\7. rcX UART` folder and open the **rcX_UART_netX51.htp** file.

➯ The project is opened and the **Download Applications** dialog appears.

➢ In the **Download Applications** dialog, click **Cancel** button (you don't want to download the application yet, you first need to build the application).

➮ The project is displayed in HiTOP:



Address	OpCo...	Instruction
0x080F6D94	03681342	andmis r6, r3, #30000h
0x080F6D98	FCD1036	stmvsda r3, {r2-r8,r12,r14,pc}
0x080F6D9C	180CECE	dw e7ec0c18h
0x080F6DA0	5023090	stmeqda r9, {r4,r6,r8,r9,r13}
0x080F6DA4	1B03000	andeq r0, r0, r11, lsl r3
0x080F6DA8	20C5181	andnes r12, r8, r0, lsr #10
0x080F6DAC	D4B80F0	stmeqda pc, {r2,r4,r6,r7,r11-r13,pc}
0x080F6DB0	30B5134	bmi 0x085E4278
0x080F6DB4	134B0D1	dw 1c0d4b13h
0x080F6DB8	D15C041	dw 1c045cd1h
0x080F6DBC	0F290DD	stmleed sp, {r0-r3,r8,r11,r13}
0x080F6DC0	CB022F2	eorcs r0, pc, #b000000ch
0x080F6DC4	13438201	orreq r4, r2, r3, lsl r3
0x080F6DC8	13432A0	streqt r4, [r10], #-313h
0x080F6DCC	13430E4	bmi 0x08487A20

r0	00000000	r11	00000000	N	0	s_I	1
r1	00000000	r12	00000001	Z	0	s_F	1
r2	00000000	r13	0809FEE0	C	0	s_T	0
r3	0000006B	r14	080F918F	V	0		
r4	00000001	r15	080F6D94	Q	0		
r5	080F6611	cpsr	000000D3	I	1		
r6	00000004	spsr	000000D3	F	1		
r7	08092504	sp	0809FEE0	T	0		
r8	080F06C9	lr	080F918F	s_N	0		
r9	080F3C35	pc	080F6D94	s_Z	0		

Target State:

Break (1): User request

CPU Clock: Not available Update

```
   Address  Data
0x00000000  FA FF FB EA DC 05 9F 96 93 DB 67 BE 25 47 02 F7
0x00000010  E8 E2 72 D4 2C 54 30 95 67 CB A5 5E C4 12 5F D8
0x00000020  13 1B E0 4C 30 3F 09 E8 96 BE EF F2 41 31 93 5B
0x00000030  AA 08 24 08 35 0B 62 73 77 9C B4 27 99 90 81 1F
0x00000040  46 F0 1F 1B F4 70 8A 62 34 A9 51 5E 7D A7 BB 3F
0x00000050  00 59 17 31 29 E7 F6 CC 1B 48 79 D7 39 1B 52 4D
```

ID	Expression	Value	Type

➪ 0x080F6D9...

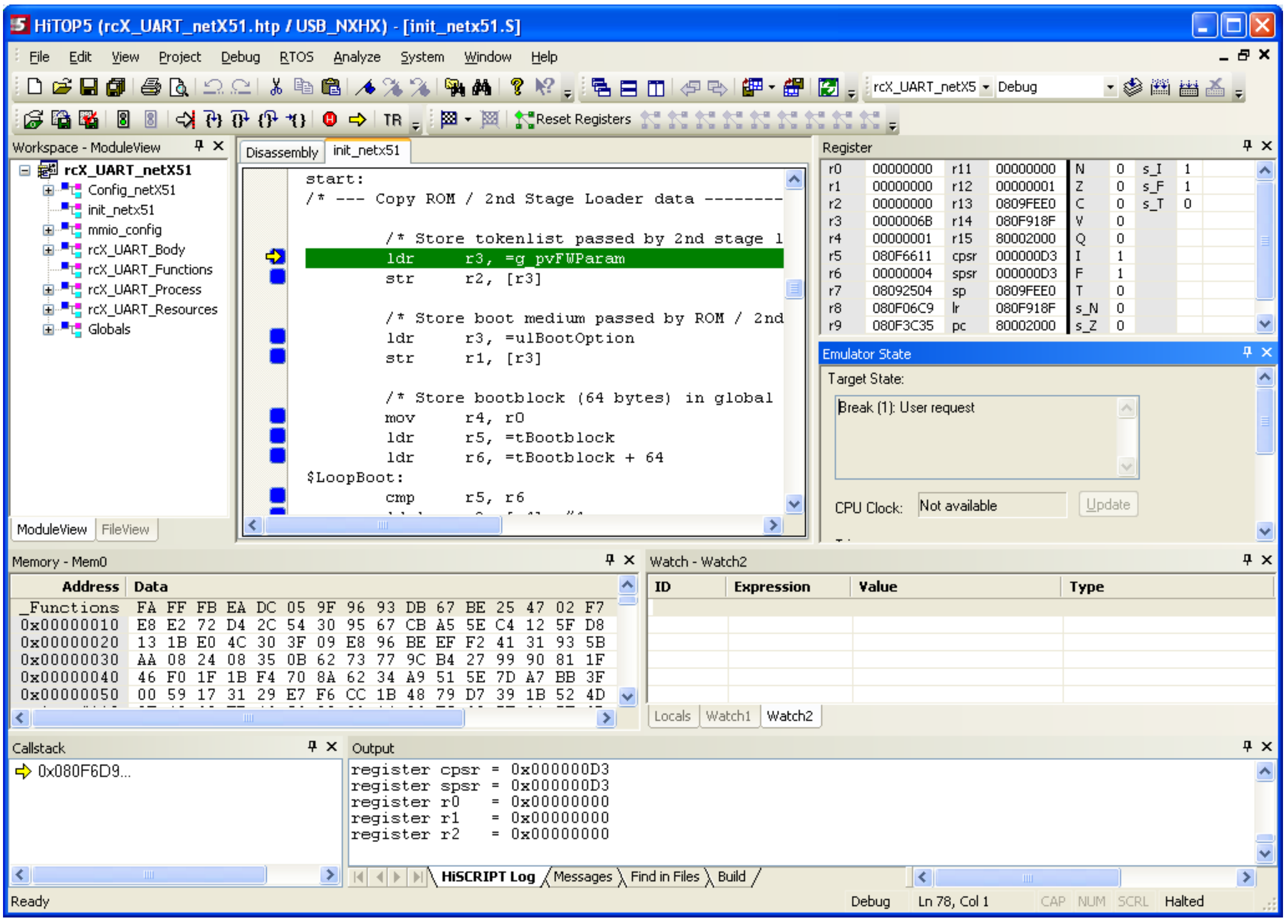
```
DUMP 0x80101E3C LEN 16 DWORD
DUMP 0x00000000 LEN 32 DWORD
DUMP 0x00000000 LEN 16 DWORD
DUMP 0x00000000 LEN 32 DWORD
DUMP 0x800993A0 LEN 16 DWORD
DUMP 0x00000000 LEN 32 DWORD
```

Figure 28: Project in HiTOP

- ➢ In the icon bar of HiTOP, click **Build** button (▦) or press F7 on your keyboard.
- ➢ Answer the question **Would you like to rebuild the affected files ?** with **Yes**.
- ➮ The project/ELF file is being compiled and the **Download Applications** dialog appears again.
- ➢ This time, choose **OK** in the **Download Applications** dialog.
- ➮ The project/ELF file is automatically downloaded to the NXHX board after the build process is finished.

7. Run netX UART example.

➢ In the icon bar of HiTOP, click **Go** button (🚦) to start the rcX UART example on the NXHX board (or press F5 on your keyboard).



```
start:
/* --- Copy ROM / 2nd Stage Loader data --------

        /* Store tokenlist passed by 2nd stage l
        ldr     r3, =g_pvFWParam
        str     r2, [r3]

        /* Store boot medium passed by ROM / 2nd
        ldr     r3, =ulBootOption
        str     r1, [r3]

        /* Store bootblock (64 bytes) in global
        mov     r4, r0
        ldr     r5, =tBootblock
        ldr     r6, =tBootblock + 64
$LoopBoot:
        cmp     r5, r6
```

r0	00000000	r11	00000000	N	0	s_I	1
r1	00000000	r12	00000001	Z	0	s_F	1
r2	00000000	r13	0809FEE0	C	0	s_T	0
r3	0000006B	r14	080F918F	V	0		
r4	00000001	r15	80002000	Q	0		
r5	080F6611	cpsr	000000D3	I	1		
r6	00000004	spsr	000000D3	F	1		
r7	08092504	sp	0809FEE0	T	0		
r8	080F06C9	lr	080F918F	s_N	0		
r9	080F3C35	pc	80002000	s_Z	0		

Target State:

Break (1): User request

CPU Clock: Not available

```
   Address  Data
_Functions  FA FF FB EA DC 05 9F 96 93 DB 67 BE 25 47 02 F7
0x00000010  E8 E2 72 D4 2C 54 30 95 67 CB A5 5E C4 12 5F D8
0x00000020  13 1B E0 4C 30 3F 09 E8 96 BE EF F2 41 31 93 5B
0x00000030  AA 08 24 08 35 0B 62 73 77 9C B4 27 99 90 81 1F
0x00000040  46 F0 1F 1B F4 70 8A 62 34 A9 51 5E 7D A7 BB 3F
0x00000050  00 59 17 31 29 E7 F6 CC 1B 48 79 D7 39 1B 52 4D
```

Callstack: 0x080F6D9...

```
register cpsr  =  0x000000D3
register spsr  =  0x000000D3
register r0    =  0x00000000
register r1    =  0x00000000
register r2    =  0x00000000
```

Ready Debug Ln 78, Col 1 CAP NUM SCRL Halted

Figure 29: Project in HiTOP (2)

➢ The running project is indicated by the 🟥 Running sign in the lower right corner of the HiTOP screen.

8. Test netX UART example with Windows **HyperTerminal** program.

Note: Windows **HyperTerminal** program is included in Windows XP, but not in Windows 7 and 8. If you are using Win 7 or 8, use an equivalent terminal program instead.

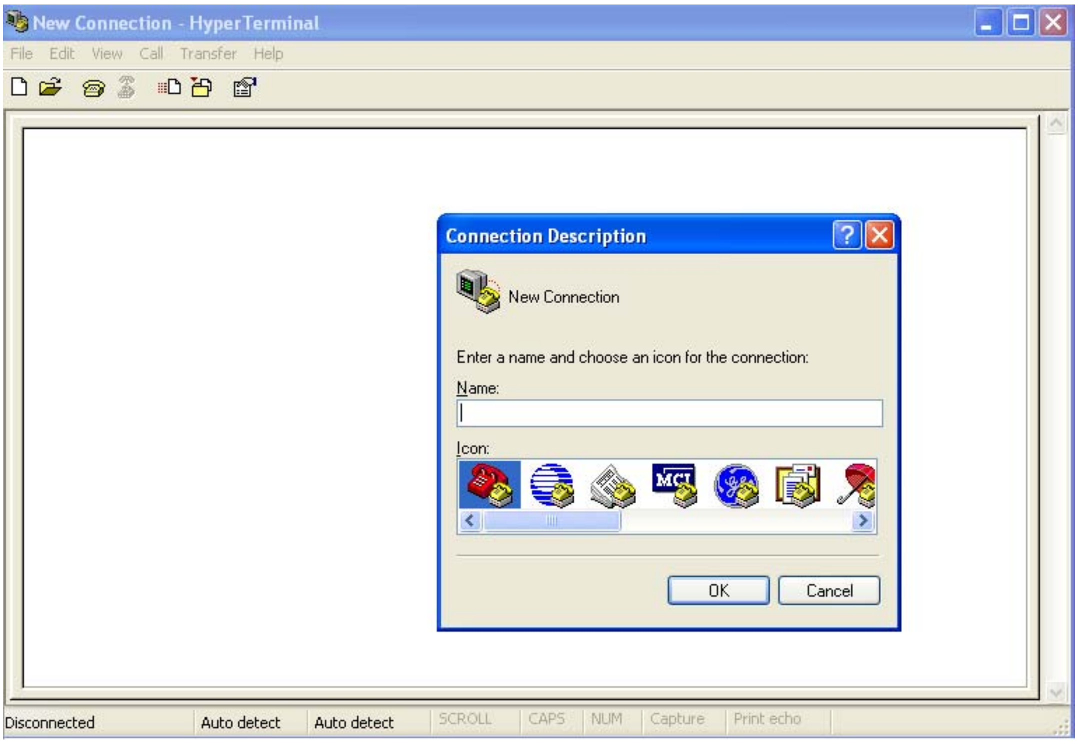
➢ In the Windows **Start** menu, choose **Accessories** > **Communications** > **HyperTerminal**.

➢ If the **Default Telnet Program?** dialog opens and asks you to make HyperTerminal your default Telnet program, click **No**.

➢ If the **Location Information** dialog opens, click **Cancel**.

Note: The **Location Information** parameters demanded by Windows are not relevant for this example. Confirm cancelling; respectively click **Cancel** each times Windows ask for these parameters.

➩ The **Connection Description** dialog opens:



Connection Description

New Connection

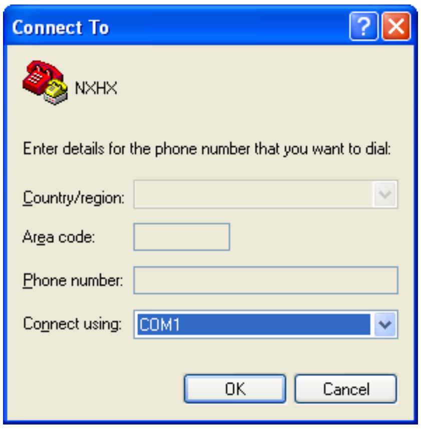
Enter a name and choose an icon for the connection:

Name:

Figure 30: Connection Description

➢ In the **Connection Description** dialog, enter any name, then click **OK**.

➩ The **Connect to** dialog opens:



Connect To

NXHX

Enter details for the phone number that you want to dial:

Country/region:

Area code:

Phone number:

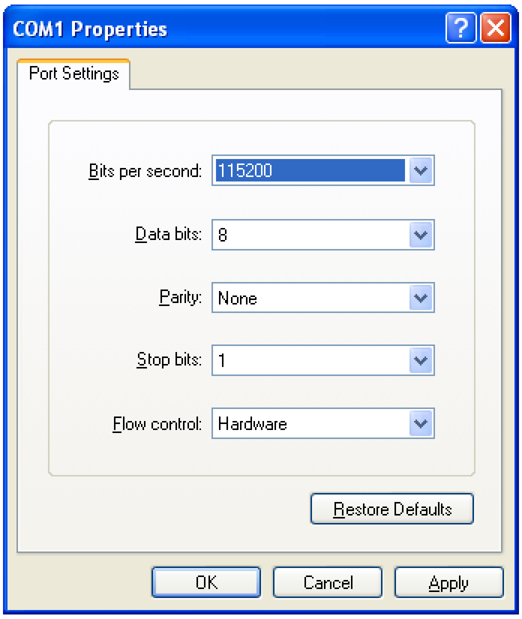
Connect using: COM1

Figure 31: Connect To Dialog

➢ In the **Connect using** drop-down list, select the COM port which is connected to the UART0 interface of the NXHX board via NULL modem cable (usually **COM1**), then click **OK**.

➩ The **Properties** sheet for the selected COM port opens.

➢ Select the parameters as shown below, then click **Apply** and **OK** button.



Bits per second: 115200

Data bits: 8

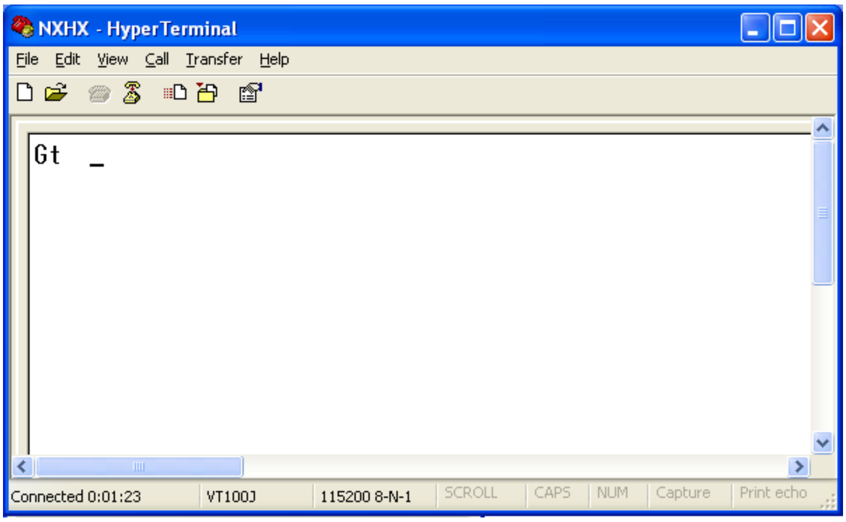
Parity: None

Stop bits: 1

Flow control: Hardware

Figure 32: COM Port Properties

➯ At last the **HyperTerminal** program opens:



```
Gt _
```

Connected 0:01:23 VT100J 115200 8-N-1

Figure 33: rcX UART Example in HyperTerminal

➢ Enter any letter.

➯ According to the programmed function of the rcX UART example, any small letter sent to the netX processor will be returned as capital letter and vice versa, e.g. the entered character string **gT** will be returned as **Gt**. (All other characters that are not letters, like e. g. numbers, are returned unchanged.)

9. Debug/alter rcX example

➢ Use the HiTOP functions to debug, respectively alter the source code according to your needs, then rebuild and download the ELF to the NXHX board again (as described in step 6).

5.5 Using Bootwizard to Create an Executable Binary Firmware File from ELF File

5.5.1 Overview

This section describes how to use the Hilscher netX Bootwizard to create an executable binary firmware from an ELF file.

5.5.2 Prerequisites

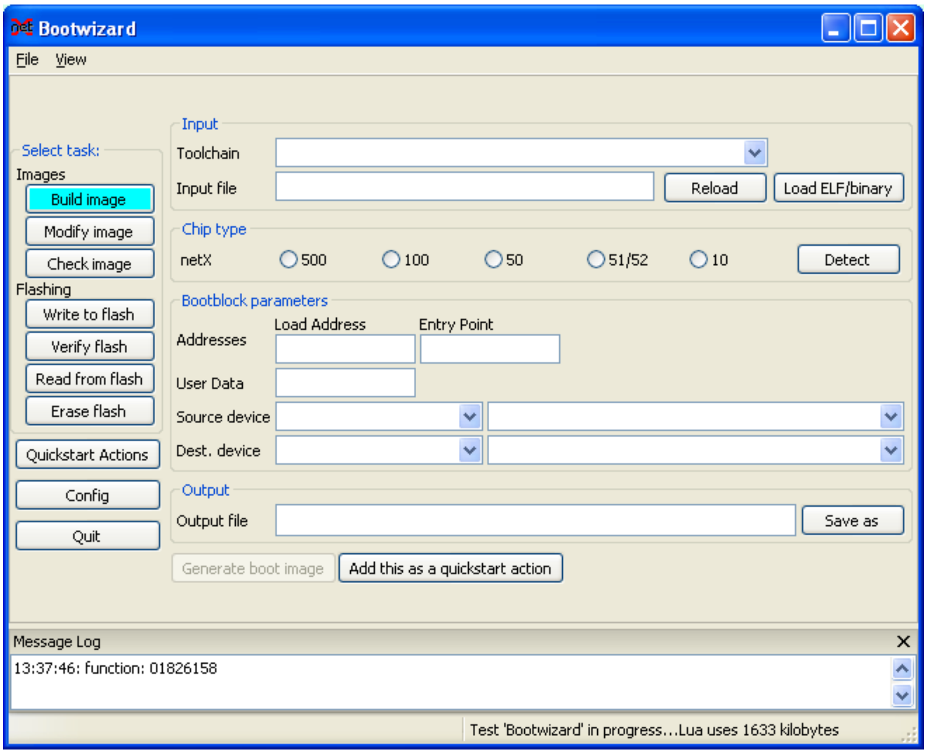
- You have installed the Hilscher netX Bootwizard application on your PC. (In the menu of the NXHX 51-ETM product DVD, choose **Software and Tools** > **Bootwizard** to open the `Tools\Bootwizard` folder, then double-click **bootwizard_1.3.xxxxx.x_setup.exe** file.)
- The compiler/linker toolchain that was used to build the ELF file (i. e. Code Sourcery) is installed on the same PC.
- You have built an ELF file (this example uses the ELF file built from the rcX UART example as described in the previous section).

5.5.3 Step-by-Step Instructions

1. Start the Bootwizard application on your PC.

➢ In the Windows **Start** menu, choose **All Programs** > **Hilscher GmbH** > **Bootwizard** > **Bootwizard**.

➪ The Bootwizard opens with the **Build image** screen (this is the default start screen):



```
13:37:46: function: 01826158
```

Test 'Bootwizard' in progress...Lua uses 1633 kilobytes

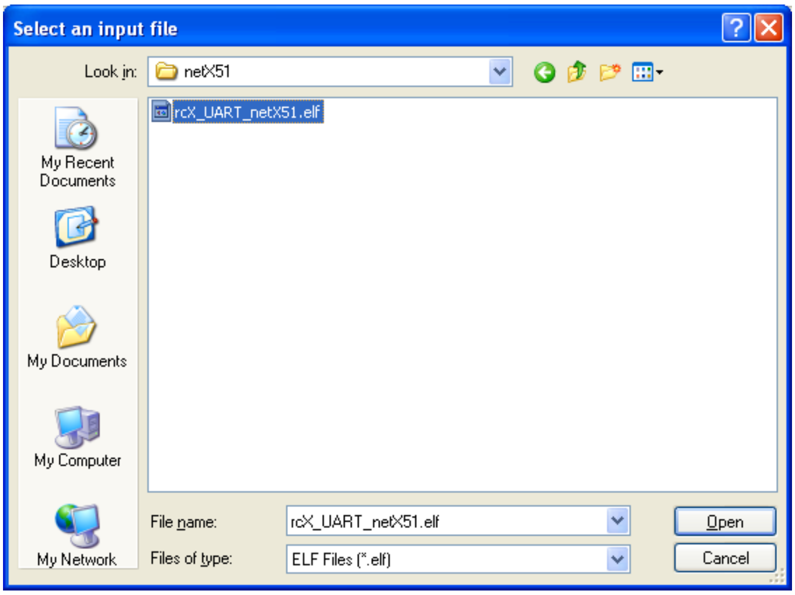
Figure 34: Bootwizard Start Screen

2. Select toolchain and ELF file.

➢ In the **Input** area, open the **Toolchain** drop-down list and select the toolchain that was used to build the ELF, in our example, this is **Codesourcery**.

➢ Click **Load ELF/binary** button next to the **Input file** field.

↳ The **Select an input file** dialog window opens:



Look in: netX51

rcX_UART_netX51.elf

File name: rcX_UART_netX51.elf

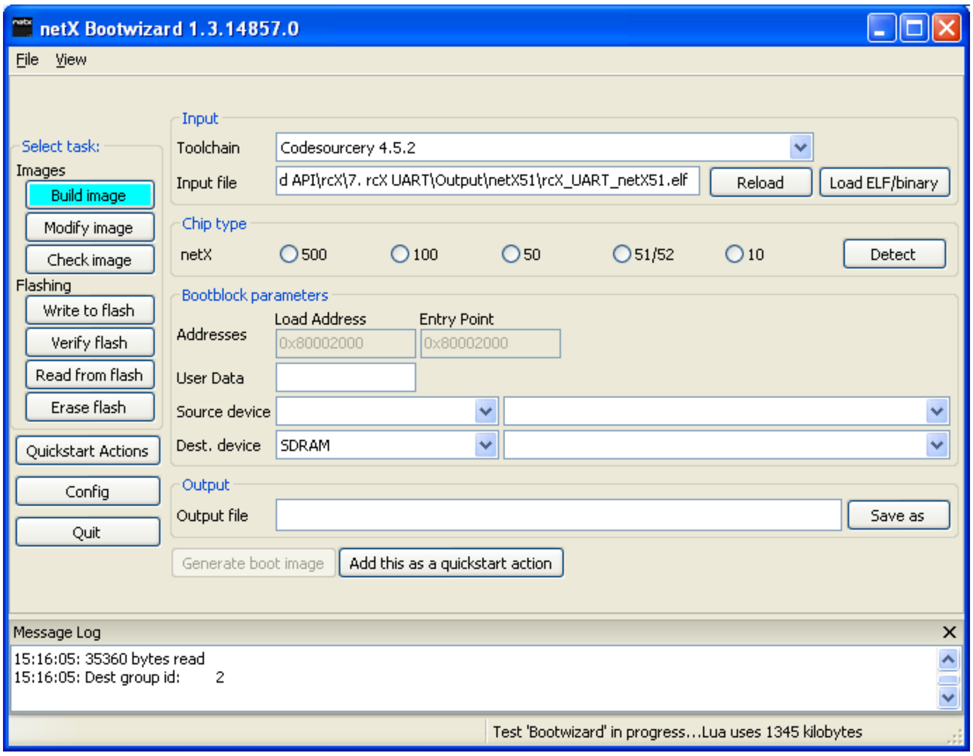
Files of type: ELF Files (*.elf)

Figure 35: Select ELF File Dialog

➢ Navigate to the directory where the ELF file is stored. In our example this is the `Examples and API\rcX\7. rcX UART\Output\netX51` directory.

➢ Select the ELF file (in our example: **rcX_UART_netX51.elf**), then click **Open** button.

➮ The Bootwizard loads the ELF file.



Toolchain: Codesourcery 4.5.2

Input file: d API\rcX\7. rcX UART\Output\netX51\rcX_UART_netX51.elf

netX: ○ 500 ○ 100 ○ 50 ○ 51/52 ○ 10

Addresses: Load Address 0x80002000, Entry Point 0x80002000

User Data:

Source device:

Dest. device: SDRAM

Output file:

```
15:16:05: 35360 bytes read
15:16:05: Dest group id:      2
```

Test 'Bootwizard' in progress...Lua uses 1345 kilobytes

Figure 36: ELF File Loaded

3. Set parameters.

➢ In the **Chip type** area, select **51/52**.

➢ In the **Bootblock parameters** area, open the first drop-down list next to **Source device** and select **Serial flash on SPI bus** entry. Open the right drop-down list and select **Generic SPI Flash netX51/52, 10MHz** entry.

Note: Because Quad SPI Flash is used on the NXHX 51-ETM board, the setting you choose in the right drop-down list of the **Source device** parameter is actually of no consequence. However, any one of these entries must be selected, otherwise the **Generate boot image** button will not be enabled.

➢ In the first drop-down list next to **Dest. device**, make sure that **SDRAM** is selected. Open the right drop-down list and select **SDRam MT48LC2M32B2-7IT** entry.

4. Specify output file.

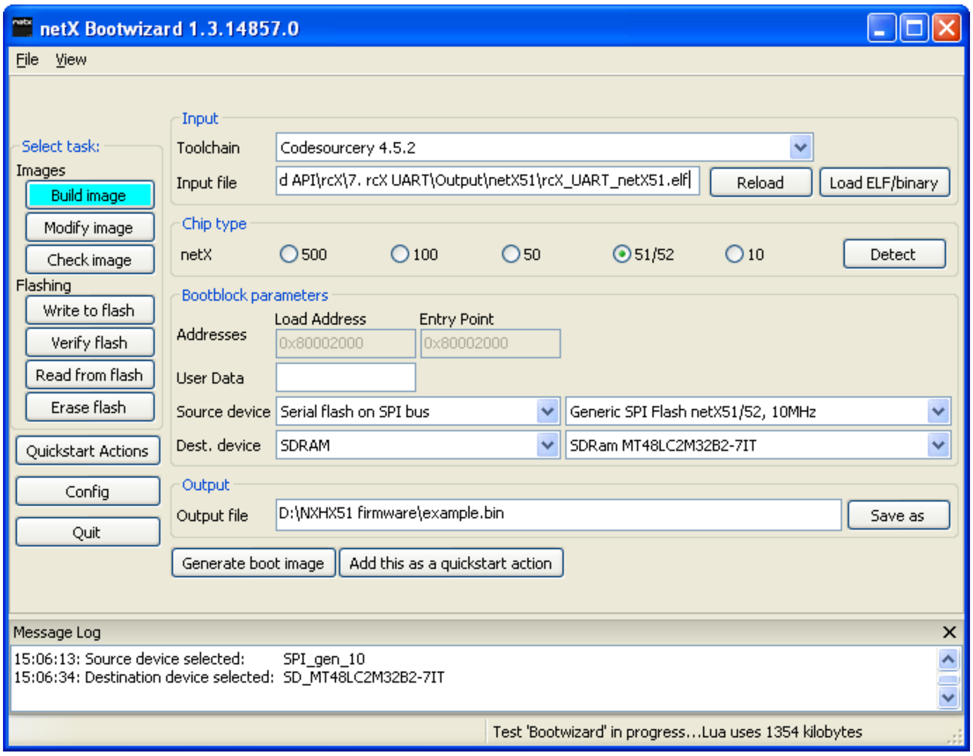
➢ In the **Output** area, click **Save as** button.

➢ The **Select the output file** dialog window opens.

➢ In the **File name** field, specify file name of the executable binary file which you want to create (the ***.bin** Boot Image), e. g. “example.bin”.

➢ Specify the output directory, then click **Save** button.

➯ The GUI should now look like this:



Input

Toolchain: Codesourcery 4.5.2

Input file: d API\rcX\7. rcX UART\Output\netX51\rcX_UART_netX51.elf

Chip type

netX: ○ 500 ○ 100 ○ 50 ● 51/52 ○ 10

Bootblock parameters

Addresses: Load Address 0x80002000, Entry Point 0x80002000

User Data:

Source device: Serial flash on SPI bus | Generic SPI Flash netX51/52, 10MHz

Dest. device: SDRAM | SDRam MT48LC2M32B2-7IT

Output

Output file: D:\NXHX51 firmware\example.bin

```
15:06:13: Source device selected:      SPI_gen_10
15:06:34: Destination device selected: SD_MT48LC2M32B2-7IT
```

Test 'Bootwizard' in progress...Lua uses 1354 kilobytes

Figure 37: Generate Boot Image Screen

5. Generate firmware file.

➢ In the **Output** area, click **Generate boot image** button.

➯ The executable binary firmware file is generated and stored in the specified output folder.

Note: The executable binary can then be downloaded and stored in the flash memory of the NXHX 51-ETM board by the Bootwizard via serial interface. Because both files are in essence executable binary images, the procedure of downloading the executable firmware is the same as for downloading a Second Stage Bootloader file. Thus, if you want to download the executable binary after having created it from ELF, you can follow the instructions provided in the *Downloading Executable Binary Image to Serial Flash of the NXHX 51-ETM via USB* section on page 46; simply select the executable binary firmware instead of the SSBL file for download.

5.6 Downloading Executable Binary Image to Serial Flash of the NXHX 51-ETM via USB

5.6.1 Overview

This section describes how to download an executable binary image from your development PC to the flash memory of your netX device via USB. For this, you need the Hilscher **netX Bootwizard** application as download tool installed on your PC and an USB cable with a Mini-B connector.

The executable binary image file can be the Second Stage Bootloader (SSBL) or customer-engineered LOM firmware.

This section is relevant to users of Standard Loadable Firmware (LFW) and users of LOM firmware alike, because users who want to operate the board with LFW or LOM firmware in NXF format need to flash the SSBL beforehand, users who want to operate the board with LOM firmware not in NXF format also need a way to flash their executable binary firmware image.

For more detailed information about the Bootwizard, please refer to the Operating Instruction Manual *netX Bootwizard*, DOC070502OIxxEN, which is stored in the `Documentation\4. Tool Manuals\Bootwizard` directory of the product DVD.

Note: To ensure successful download, the serial flash memory of the NXHX 51-ETM board needs to be empty. The NXHX 51-ETM is delivered with an empty serial flash memory. If you have already downloaded any file to the serial flash, use the Bootwizard application to erase it before you proceed to download the binary image. Instructions for this are provided in the *netX Bootwizard* manual.

5.6.2 Prerequisites

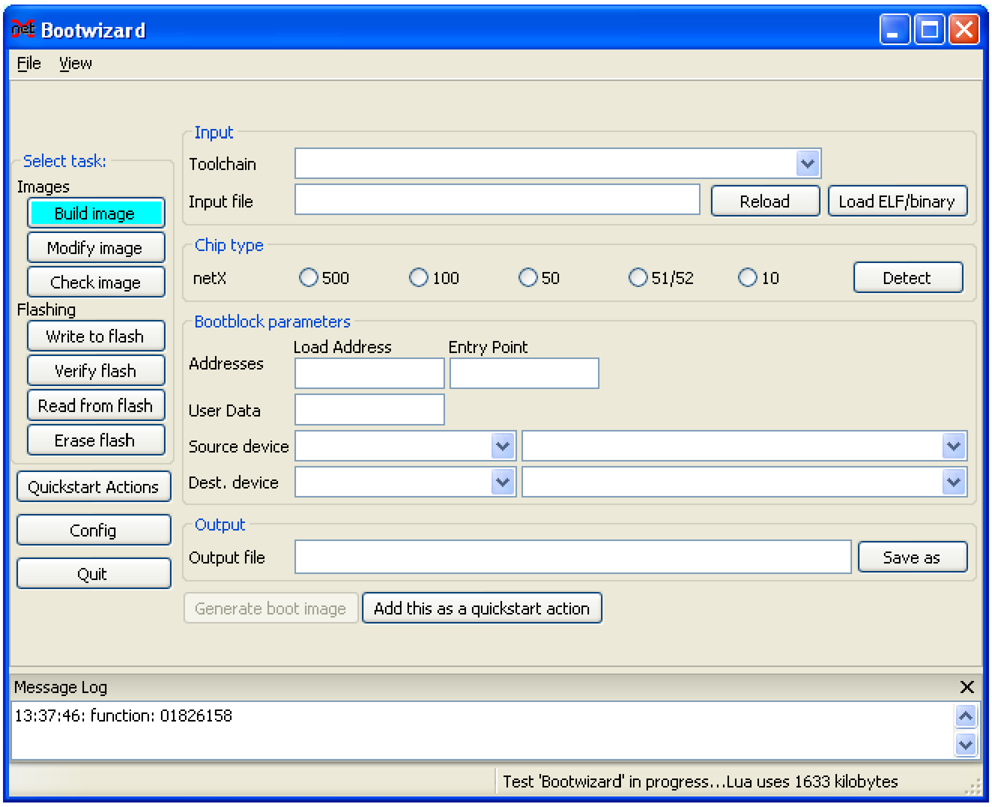
- You have installed the Hilscher netX Bootwizard application on your PC. (In the menu of the NXHX 51-ETM product DVD, choose **Software and Tools** > **BootWizard** to open the `Tools\Bootwizard` folder, then double-click **bootwizard_1.3.xxxxx.x_setup.exe** file.)
- The NXHX board is connected to a voltage supply.
- You have a USB cable with a Mini-B connector ready.
- You have access to the image which you want to download. In case of the SSBL, this is the **NETX51-BSL.bin** file stored on the NXHX 51-ETM product DVD in the `Tools\2nd Stage Bootloader` directory.

5.6.3 Step-by-Step Instructions

1. Start the Bootwizard application on your PC.

➢ In the Windows **Start** menu, choose **All Programs** > **Hilscher GmbH** > **Bootwizard** > **Bootwizard**.

➯ The Bootwizard opens:



```
13:37:46: function: 01826158
```

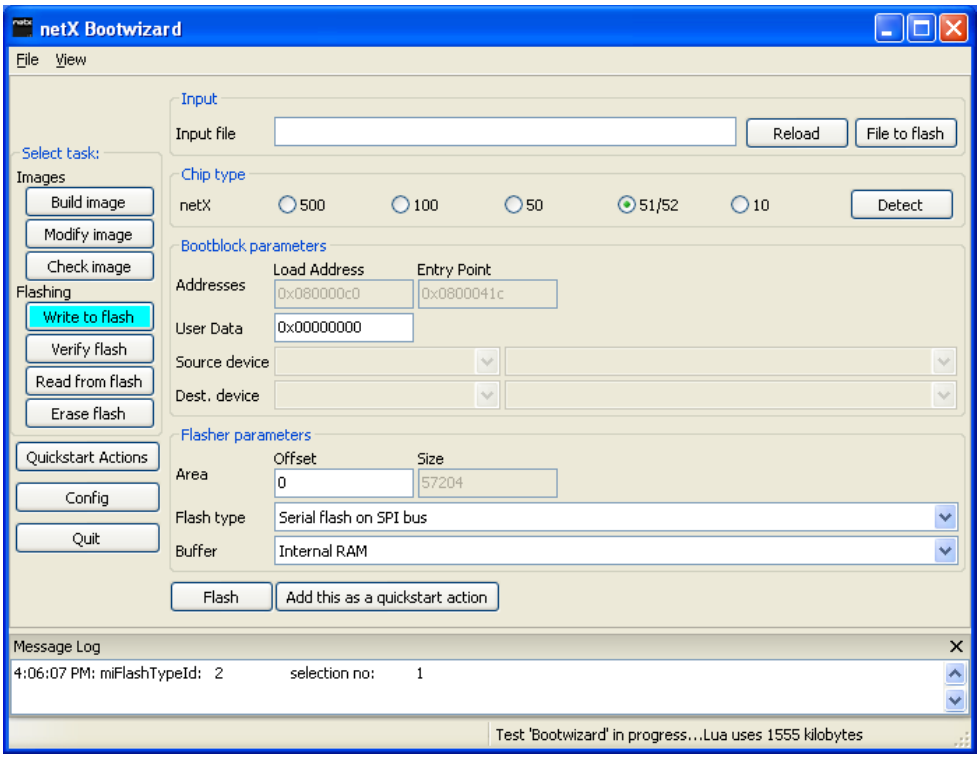
Test 'Bootwizard' in progress...Lua uses 1633 kilobytes

Figure 38: Bootwizard Start Screen

2. Choose flashing task.

➢ In the **Select Task** area, click **Write to flash** button.

- The Bootwizard shows the fields and controls for the chosen **Write to flash** task:



Input file:

netX: ○ 500 ○ 100 ○ 50 ● 51/52 ○ 10

Addresses: Load Address 0x080000c0, Entry Point 0x0800041c

User Data: 0x00000000

Source device:

Dest. device:

Area: Offset 0, Size 57204

Flash type: Serial flash on SPI bus

Buffer: Internal RAM

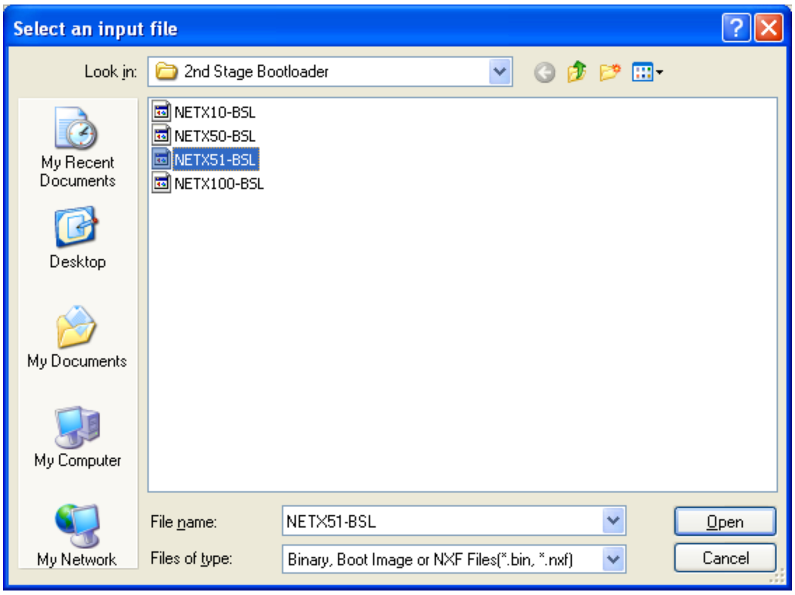
```
4:06:07 PM: miFlashTypeId:  2        selection no:       1
```

Test 'Bootwizard' in progress...Lua uses 1555 kilobytes

Figure 39: Bootwizard Write to Flash Screen

3. Select the image to be downloaded.

- In the **Input** area, click **File to flash** button.
- The **Select an input file** dialog window opens:



Look in: 2nd Stage Bootloader

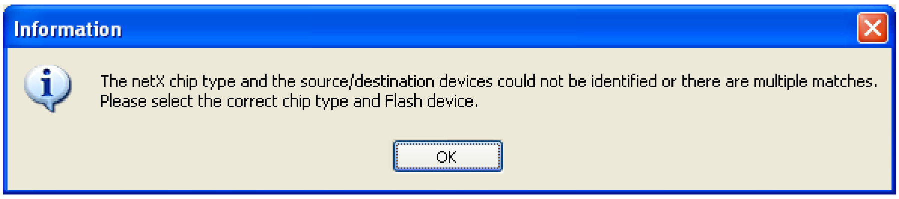
NETX10-BSL
NETX50-BSL
NETX51-BSL
NETX100-BSL

File name: NETX51-BSL

Files of type: Binary, Boot Image or NXF Files(*.bin, *.nxf)

Figure 40: Select Input File Dialog

- ➢ Navigate to the directory where the image is stored. In case of the SSBL, this is the `Tools\2nd Stage Bootloader` directory on the product DVD.
- ➢ Select the image file (in case of the SSBL, this is the **NETX51-BSL.bin** file), then click **Open** button.
- ➪ The Bootwizard opens file. The following message appears:



Information

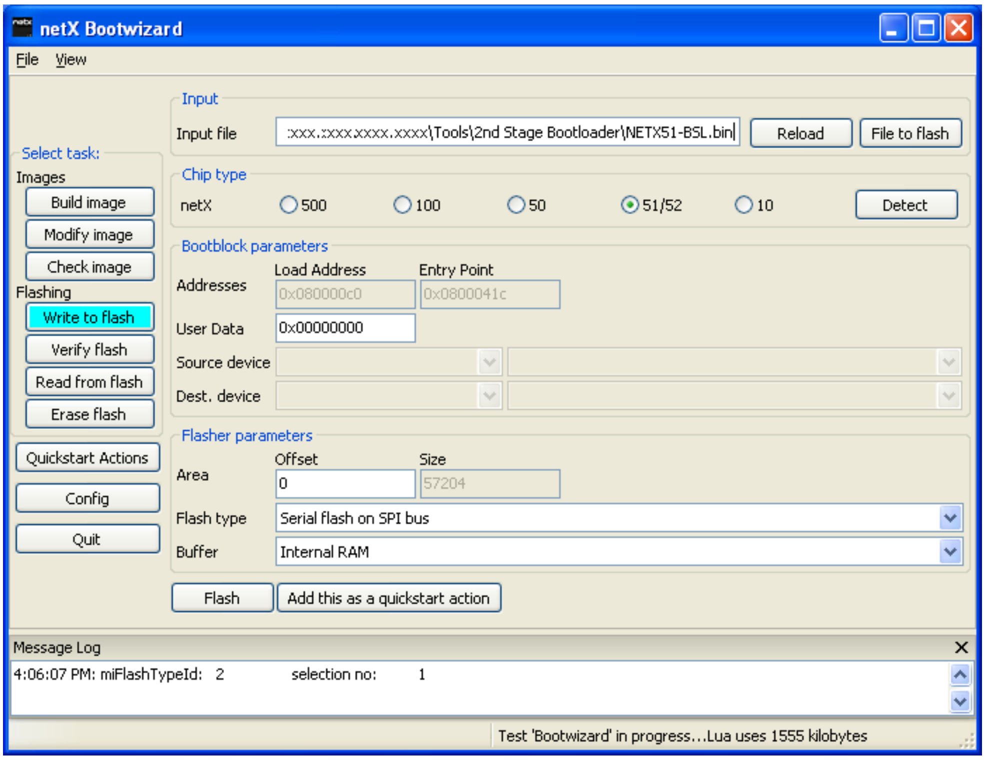
The netX chip type and the source/destination devices could not be identified or there are multiple matches.
Please select the correct chip type and Flash device.

Figure 41: Bootwizard Message

- ➢ Click **OK**.

4. Select Chip type.

- ➢ In the **Chip type** area, select **51/52**.
- ➪ The GUI should now look like this:



netX Bootwizard

Input file: :xxx.:xxxx.xxxx.xxxx\Tools\2nd Stage Bootloader\NETX51-BSL.bin

Chip type: netX ○ 500 ○ 100 ○ 50 ● 51/52 ○ 10

Bootblock parameters
Addresses: Load Address 0x080000c0, Entry Point 0x0800041c
User Data: 0x00000000
Source device
Dest. device

Flasher parameters
Area: Offset 0, Size 57204
Flash type: Serial flash on SPI bus
Buffer: Internal RAM

Message Log

```
4:06:07 PM: miFlashTypeId:   2          selection no:       1
```

Test 'Bootwizard' in progress...Lua uses 1555 kilobytes

Figure 42: Selected File in Write to Flash Screen

5. Put the NXHX 51-ETM into serial boot mode.

➢ Use the S1 switch on the NXHX board (see position ⑤ in *Device Drawing and Positions of the NXHX 51-ETM* chapter on page 16) to set the boot strap options to **SERIAL boot mode**. Use the following settings:

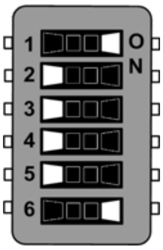
S1	SW	Setting
	1	on
	2	off
	3	off
	4	off
	5	off
	6	on

Table 3: Settings for Serial Boot Mode at Switch S1

➢ Push the **Reset** button (T1) on the NXHX board (see position ⑲ in *Device Drawing and Positions of the NXHX 51-ETM* chapter on page 16).

⇨ The SYS LED on the NXHX board (see position ⑱ in *Device Drawing and Positions of the NXHX 51-ETM* chapter on page 16) which up to this point has been blinking yellow (on/off) now alternates between brighter and darker yellow, indicating serial boot mode.

6. Establish an USB connection.

➢ Plug an USB cable into the Mini-B USB socket on the NXHX board (see position ⑳ in *Device Drawing and Positions of the NXHX 51-ETM* section on page 16) and connect the USB cable to your PC.

Note: The USB drivers needed for connecting the Bootwizard to the NXHX board have automatically been installed on your PC by the Bootwizard setup program. However, under **Windows XP**, the installation process of the USB drivers needs to be completed in the **Found New Hardware Wizard**, which opens when you connect the NXHX board for the first time to your PC. For finishing the installation of the USB drivers in the wizard, follow the instructions given below. The **Found New Hardware Wizard** opens twice: for the **netX51 Bootmonitor (CDC)** driver and for the **netX51 USB Bootmonitor (ROM)** driver.

Under **Windows 7** and **8**, the **Installing device driver software** message appears in the Windows task bar when you connect the NXHX board to the PC via USB cable for the first time. Windows then automatically copies the driver files to the appropriate Windows directories, you do not need to take any action in this.

If you are using Windows XP:

7. Finish installation of USB drivers in the **Found New Hardware Wizard**.

➢ In the start screen of the **Found New Hardware Wizard**, answer the question **Can Windows connect to Windows Update…?** by selecting the **No, not this time** option.

➢ Click **Next** button.

➢ In the next screen, answer the question **What do you want the wizard to do?** by selecting **Install the software automatically** option.

➢ Click **Next**.

⤷ Windows then copies the driver files to the Windows directories.

➢ In the **Completing the Found New Hardware Wizard** screen, click **Finish** button.

8. Check USB connection in Device Manager (Windows XP).

➢ In the **Start menu,** choose **Control Panel** entry.

⤷ The **Control Panel** window opens.

➢ In the **Control Panel**, double-click on **System** entry.

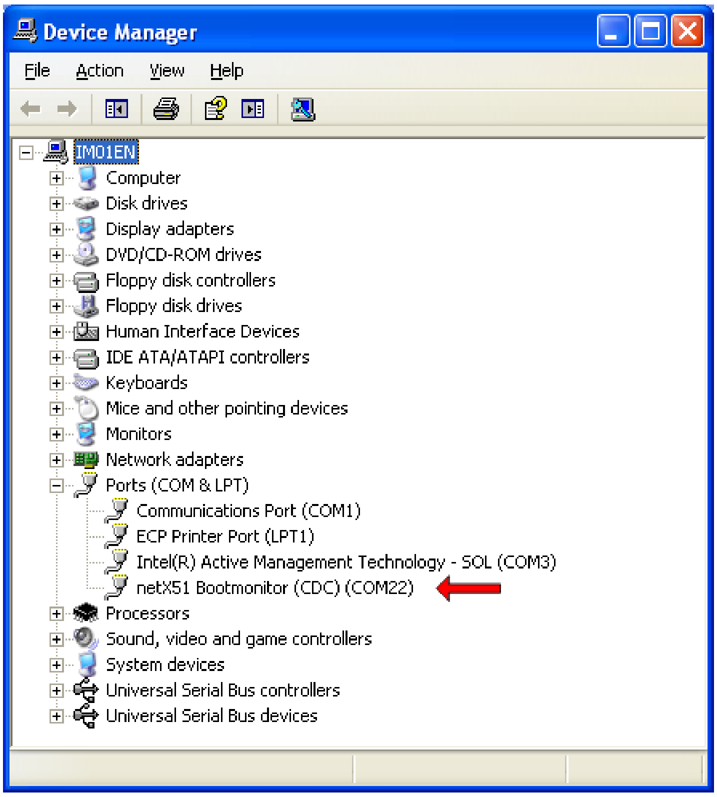
⤷ The **System Properties** sheet opens.

➢ In the **System Properties** sheet, select **Hardware** tab.

➢ In the **Hardware** tab, click **Device Manager** button.

⤷ The **Device Manager** window opens.

➢ Check the entries under **Ports (COM & LPT)** for the **netX51 Bootmonitor**.



```
⊟ IM01EN
  ⊞ Computer
  ⊞ Disk drives
  ⊞ Display adapters
  ⊞ DVD/CD-ROM drives
  ⊞ Floppy disk controllers
  ⊞ Floppy disk drives
  ⊞ Human Interface Devices
  ⊞ IDE ATA/ATAPI controllers
  ⊞ Keyboards
  ⊞ Mice and other pointing devices
  ⊞ Monitors
  ⊞ Network adapters
  ⊟ Ports (COM & LPT)
      Communications Port (COM1)
      ECP Printer Port (LPT1)
      Intel(R) Active Management Technology - SOL (COM3)
      netX51 Bootmonitor (CDC) (COM22)
  ⊞ Processors
  ⊞ Sound, video and game controllers
  ⊞ System devices
  ⊞ Universal Serial Bus controllers
  ⊞ Universal Serial Bus devices
```

Figure 43: Check USB Connection to netX 51 Bootmonitor in Windows XP

⤷ The number of the COM port of your PC currently connected to the NXHX board is indicated in brackets. In this example, **COM22** is connected to the **netX51 Bootmonitor** (i. e. the ROM Loader running in the netX 51 controller on the NXHX board).

➢ Note or write down the number of the COM port (you will need the COM number in the next step), then close the **Device Manager**.

If you are using Windows 7 or 8:

8. Check USB connection (Windows 7 and 8):

➢ In the **Start** menu, choose **Control Panel** entry.

➯ The **Control Panel** window opens.

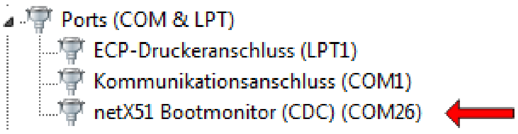
➢ In the **Control Panel** window, choose **Hardware and Sound** entry.

➯ The **Hardware and Sound** window opens.

➢ In the **Hardware and Sound** window, below **Devices and Printers**, click **Device Manager** entry.

➯ The **Device Manager** window opens.

➢ Check the entries under **Ports (COM & LPT)** for the **netX51 Bootmonitor**.



Ports (COM & LPT)
ECP-Druckeranschluss (LPT1)
Kommunikationsanschluss (COM1)
netX51 Bootmonitor (CDC) (COM26)

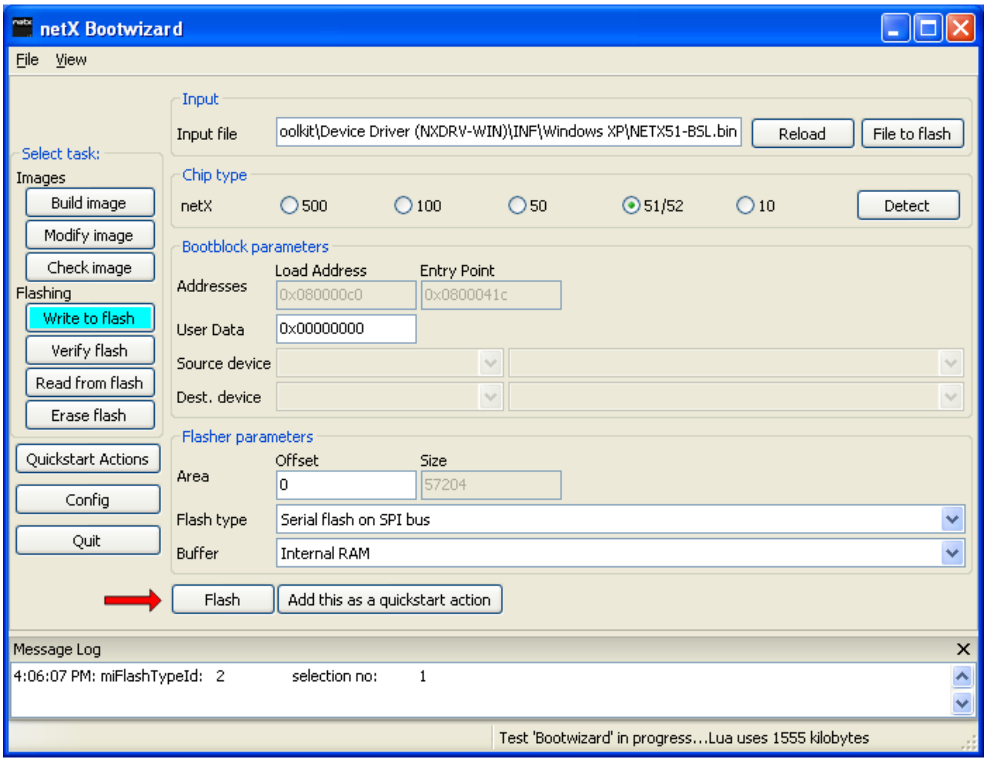
Figure 44: Check USB Connection to netX 51 in Windows 7

➯ The number of the COM port of your PC currently connected to the NXHX board is indicated in brackets. In this example, **COM26** is connected to the **netX51 Bootmonitor** (i. e. the ROM Loader running in the netX 51 controller on the NXHX board).

➢ Note or write down the number of the COM port (you will need the COM number in the next step), then close the **Device Manager**.

9. Download image file.

➢ In the Bootwizard, click **Flash** button.



Input file: oolkit\Device Driver (NXDRV-WIN)\INF\Windows XP\NETX51-BSL.bin

netX: ○ 500 ○ 100 ○ 50 ● 51/52 ○ 10

Addresses: Load Address 0x080000c0, Entry Point 0x0800041c

User Data: 0x00000000

Area: Offset 0, Size 57204

Flash type: Serial flash on SPI bus

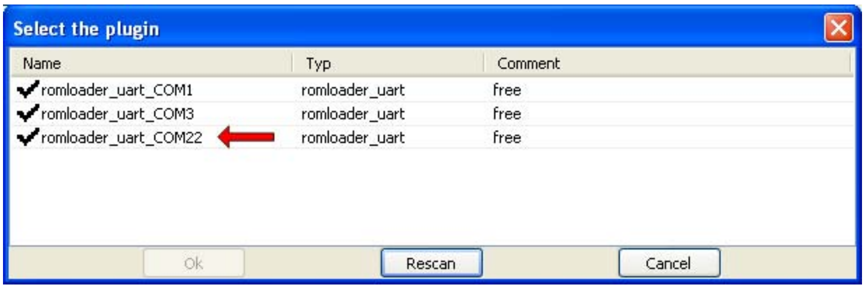
Buffer: Internal RAM

```
4:06:07 PM: miFlashTypeId:  2          selection no:       1
```

Test 'Bootwizard' in progress...Lua uses 1555 kilobytes

Figure 45: Write to Flash Screen

➩ The plugin selector opens:



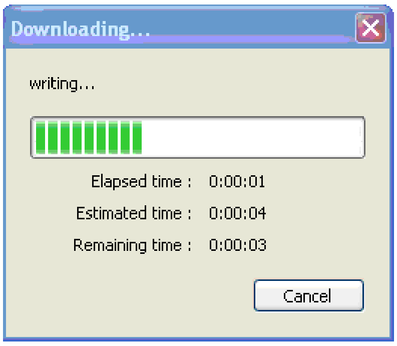
Name	Typ	Comment
✓ romloader_uart_COM1	romloader_uart	free
✓ romloader_uart_COM3	romloader_uart	free
✓ romloader_uart_COM22	romloader_uart	free

Figure 46: Plugin Selector for netX 51 Rom Loader

➢ Select the COM port connected to the netX51 Bootmonitor (the COM number which you have found out in the Device Manager in the previous step).

➢ Click **OK** button (or double-click the relevant COM port entry).

➩ The Bootwizard now sends the data file and the flasher program to the NXHX board and runs the flasher. While downloading, a progress bar is shown:



Downloading...

writing...

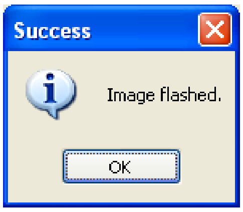
Elapsed time : 0:00:01

Estimated time : 0:00:04

Remaining time : 0:00:03

Figure 47: Progress Window

➩ Finally, a success or error message is shown:



Success

Image flashed.

Figure 48: Flashing Successful Message

➩ The SYS LED on the NXHX board (see position ⑱ in *Device Drawing and Positions of the NXHX 51-ETM* chapter on page 16) shows steady yellow.

10. Change boot mode and reset the NXHX board.

➢ Disconnect the USB cable from the NXHX board.

➢ Use the S1 switch on the NXHX board (see position ⑤ in *Device Drawing and Positions of the NXHX 51-ETM* chapter on page 16) to set the boot strap options to **FLASH boot mode**. Use the following settings:

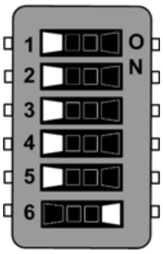
S1	SW	Setting
	1	off
	2	off
	3	off
	4	off
	5	off
	6	on

Table 4: Set Flash Boot Mode at Switch S1

➢ Push the **Reset** button (T1) on the NXHX board (see position ⑲ in *Device Drawing and Positions of the NXHX 51-ETM* chapter on page 16).

➩ The executable binary image is loaded from flash memory and then runs in the internal RAM of the netX 51. In case of the Second Stage Bootloader, the SSBL running in the internal RAM is now searching for NXF firmware to boot. This is indicated by the SYS LED (see position ⑱ in *Device Drawing and Positions of the NXHX 51-ETM* chapter on page 16) alternating between yellow and green.

5.7 Downloading NXF Firmware to Serial Flash of the NXHX 51-ETM via USB

5.7.1 Overview

This section describes how to download a LFW or a LOM file in NXF format from your development PC to the flash memory of your netX device via USB.
Note that the Second Stage Bootloader must have been downloaded to the NXHX board before you can download or boot any firmware in NXF format. Unlike the SSBL file, firmware in NXF format can not be downloaded to flash memory by using the **netX Bootwizard** application, because the Bootwizard can not cope with the file system set up by the SSBL already running on the NXHX board. Therefore, you need another Hilscher application to download the firmware file, the **netHOST Device Test Application**. The netHOST Device Test Application is stored on the product DVD in the `Tools\netX Transport` directory and can be run directly from DVD, it does not need to be installed on your PC.

A ready-made LFW PROFINET IO Device NXF firmware for testing and evaluation purposes (limited IO data exchange of 2 Bytes) is stored on the product DVD in the `Examples and API\LFW\1. LFW netX Toolkit\Firmware\PROFINET` directory.

As an alternative, you can also download the LOM PROFINET IO Device firmware in NXF format, which has also limited IO data exchange of 2 Bytes. Note that you first have to build it by using Waf with the **release** option. The code and libraries for this example are provided in the `Examples and API\LOM\2. LOM Build LFW` directory. After the build process, the firmware with the file name **LOM_PNS.nxf** will be stored in the `Examples and API\build\release\LOM\2. LOM Build LFW` directory.

5.7.2 Prerequisites

- You have downloaded the Second Stage Bootloader to the NXHX board.
- The NXHX board is connected to a voltage supply.
- You have a USB cable with a Mini-B connector ready.
- You have installed the Hilscher USB device drivers on your PC. (On the NXHX 51-ETM product DVD, open the `Driver and Toolkit\USB Driver` directory, then double-click **setup.exe** file. Follow the instructions of the installation wizard)
- You have inserted the NXHX 51-ETM product DVD into the DVD drive of your development PC (in order to be able to access the **netHOST Device Test Application**).
- You have access to the firmware file which you want to download.

5.7.3 Step-by-Step Instructions

1. Run the Second Stage Bootloader on the NXHX board.

➢ Use the S1 switch on the NXHX board (see position ⑤ in *Device Drawing and Positions of the NXHX 51-ETM* chapter on page 16) to set the boot strap options to **FLASH boot mode**. Use the following settings:

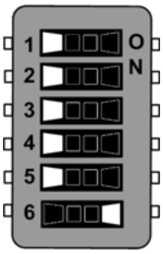
S1	SW	Setting
	1	off
	2	off
	3	off
	4	off
	5	off
	6	on

Table 5: Set Flash Boot Mode at Switch S1

➢ Push the **Reset** button (T1) on the development board (see position ⑲ in *Device Drawing and Positions of the NXHX 51-ETM* chapter on page 16).

⇨ The Second Stage Bootloader is loaded and then runs in the internal RAM of the netX 51, searching for firmware to boot. This is indicated by the SYS LED (see position ⑱ in *Device Drawing and Positions of the NXHX 51-ETM* chapter on page 16) alternating between yellow and green.

2. Establish USB connection.

➢ Plug an USB cable into the Mini-B USB socket on the NXHX board (see position ⑳ in *Device Drawing and Positions of the NXHX 51-ETM* section on page 16) and connect the USB cable to your PC.

Note: The Second Stage Bootloader, which you have downloaded in the previous section and which is now running on the NXHX board, sends a new USB identification that differs from the identification which had been sent by the ROM Loader running on the NXHX board when you first connected it via USB in order to download the Second Stage Bootloader. Therefore, it is necessary to briefly disconnect the USB cable after you have downloaded the SSBL, before you proceed to download the firmware, so that Windows can recognize the new USB ID.

If the **Found New Hardware Wizard** opens under **Windows XP**, answer the question **Can Windows connect to Windows Update…?** by selecting the **No, not this time** option. In the next screen, answer the question **What do you want the wizard to do?** by selecting **Install the software automatically** option.

3. Check USB connection in Device Manager under **Windows XP**:

➢ In the **Start menu,** choose **Control Panel** entry

↳ The **Control Panel** window opens.

➢ In the **Control Panel**, double-click on **System** entry.

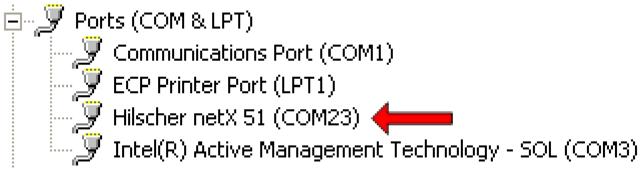
↳ The **System Properties** sheet opens.

➢ In the **System Properties** sheet, select **Hardware** tab.

➢ In the **Hardware** tab, click **Device Manager** button.

↳ The **Device Manager** window opens.

➢ Check the entries under **Ports (COM & LPT)** for the **netX 51**.



Ports (COM & LPT)
- Communications Port (COM1)
- ECP Printer Port (LPT1)
- Hilscher netX 51 (COM23)
- Intel(R) Active Management Technology - SOL (COM3)

Figure 49: Check USB Connection to netX 51 in Windows XP

↳ The number of the COM port of your PC currently connected to the NXHX board is indicated in brackets. In this example, **COM23** is connected to the **netX 51** (i. e. the Second Stage Bootloader running in the netX 51 controller on the NXHX board).

3. Check USB connection in Device Manager under **Windows 7** or **8**:

➢ In the **Start** menu, choose **Control Panel** entry.

↳ The **Control Panel** window opens.

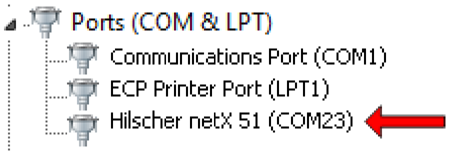
➢ In the **Control Panel** window, choose **Hardware and Sound** entry.

↳ The **Hardware and Sound** window opens.

➢ In the **Hardware and Sound** window, below **Devices and Printers**, click **Device Manager** entry.

↳ The **Device Manager** window opens.

➢ Check the entries under **Ports (COM & LPT)** for the **netX 51**.



Ports (COM & LPT)
- Communications Port (COM1)
- ECP Printer Port (LPT1)
- Hilscher netX 51 (COM23)

Figure 50: Check USB Connection to netX 51 in Windows 7

↳ The number of the COM port of your PC currently connected to the NXHX board is indicated in brackets. In this example, **COM23** is connected to the **netX 51** (i. e. the Second Stage Bootloader running in the netX 51 controller on the NXHX board).

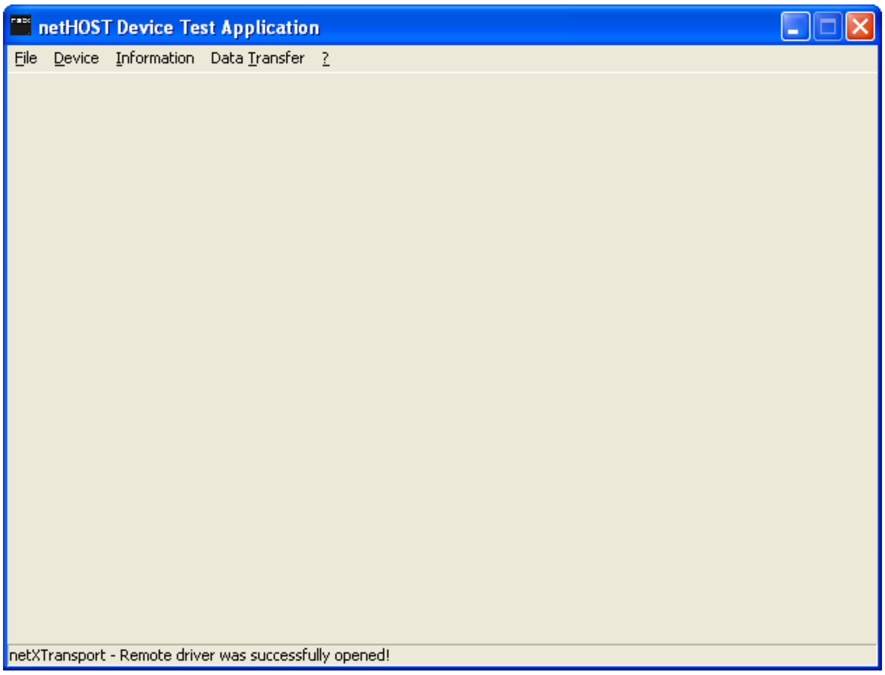
4. Open the **netHOST Device Test Application** on your PC.

➢ Insert the NXHX 51-ETM product DVD into your local DVD drive.

➢ Use the Windows Explorer to open the directory `Tools\netX Transport` on the DVD.

➢ Double-click **netHOST.exe**.

➪ The **netHOST Device Test Application** opens:



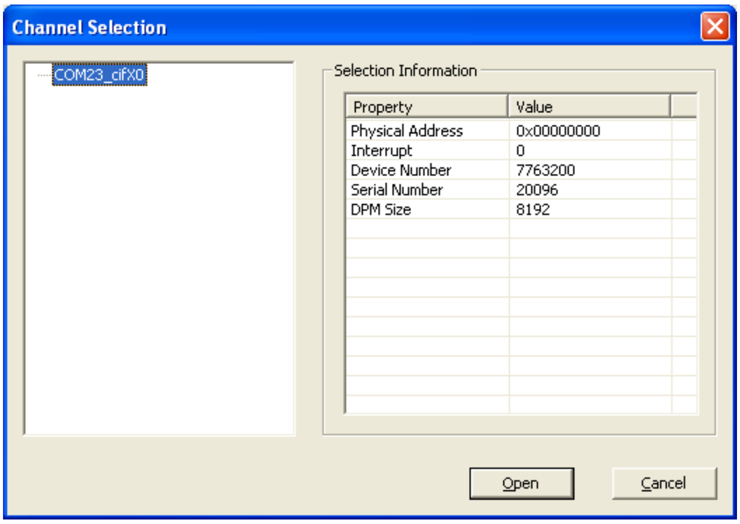
netXTransport - Remote driver was successfully opened!

Figure 51: netHOST Device Test Application Start Screen

5. Open connection to NXHX board.

➢ In the menu, choose **Device** > **Open** and wait for a few seconds.

➪ After a while, the **Channel Selection** dialog box opens:

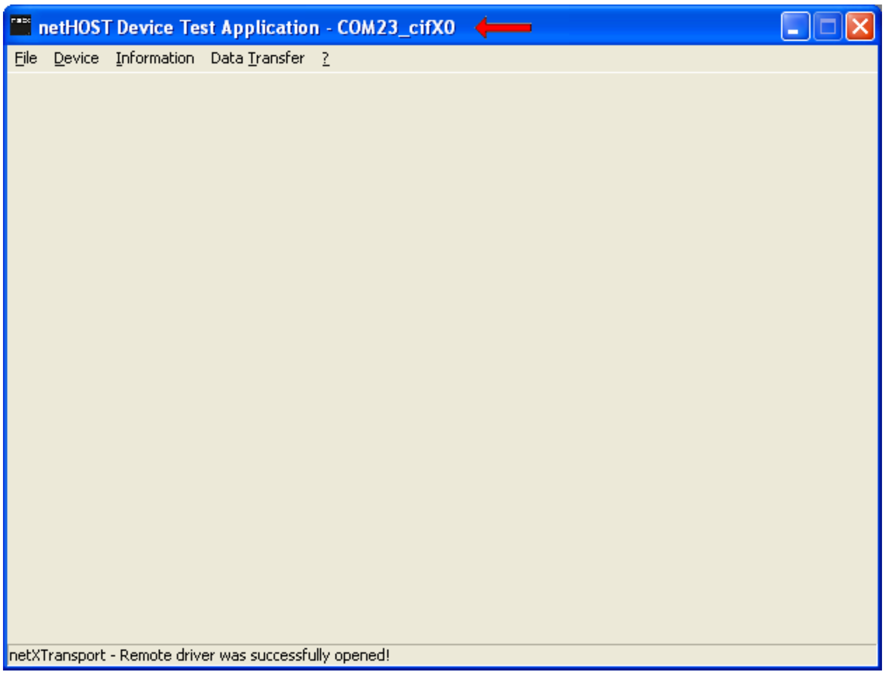


Property	Value
Physical Address	0x00000000
Interrupt	0
Device Number	7763200
Serial Number	20096
DPM Size	8192

Figure 52: Channel Selection Dialog

➢ In the left part of the dialog box, select the COM port to which the NXHX board is connected via USB, then click **Open** button.

➾ The **Channel Selection** dialog box closes, and back in the **netHOST Device Test Application** window, the header displays the selected channel:


netHOST Device Test Application - COM23_cifX0
File Device Information Data Transfer ?

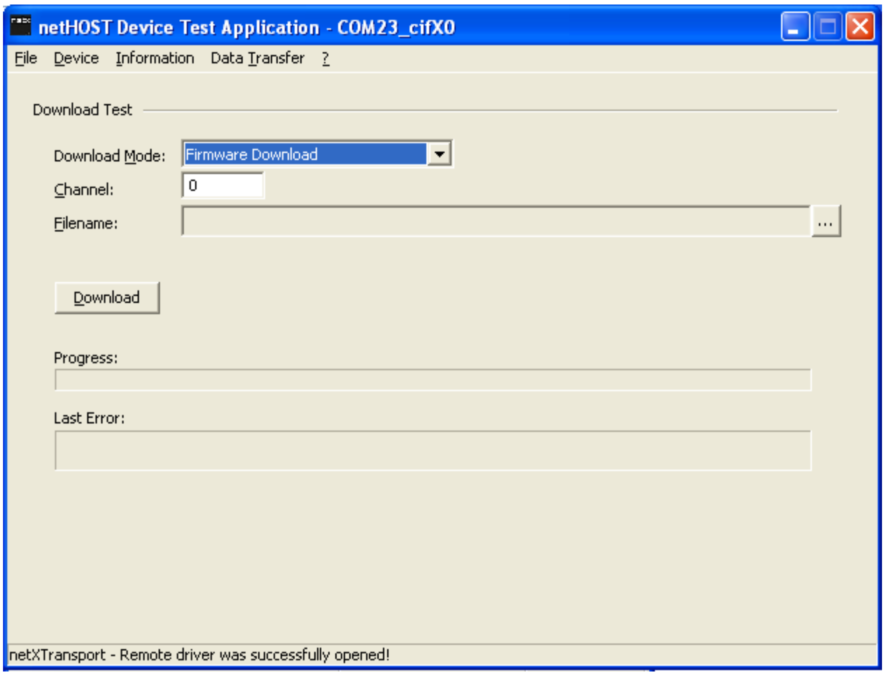
netXTransport - Remote driver was successfully opened!

Figure 53: netHOST Device Test Application After Channel Selection

6. Select firmware file.

➢ In the menu, choose **Device** > **Download**.

➾ The **Download** window opens:


netHOST Device Test Application - COM23_cifX0
File Device Information Data Transfer ?
Download Test
...
Download
Progress:
Last Error:

Download Mode: Firmware Download

Channel: 0

Filename:

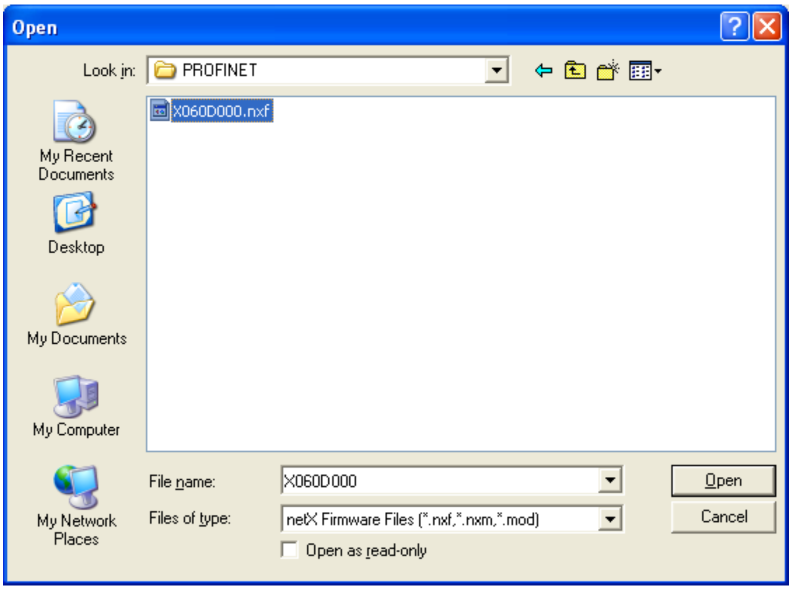
netXTransport - Remote driver was successfully opened!

Figure 54: Download Window

➢ In the **Download Mode** drop-down list, choose **Firmware Download**.

➢ Click … button next to the **Filename** field.

➾ The Windows file selection dialog opens:



Look in: PROFINET

X060D000.nxf

File name: X060D000

Files of type: netX Firmware Files (*.nxf,*.nxm,*.mod)

□ Open as read-only

Figure 55: File Selection

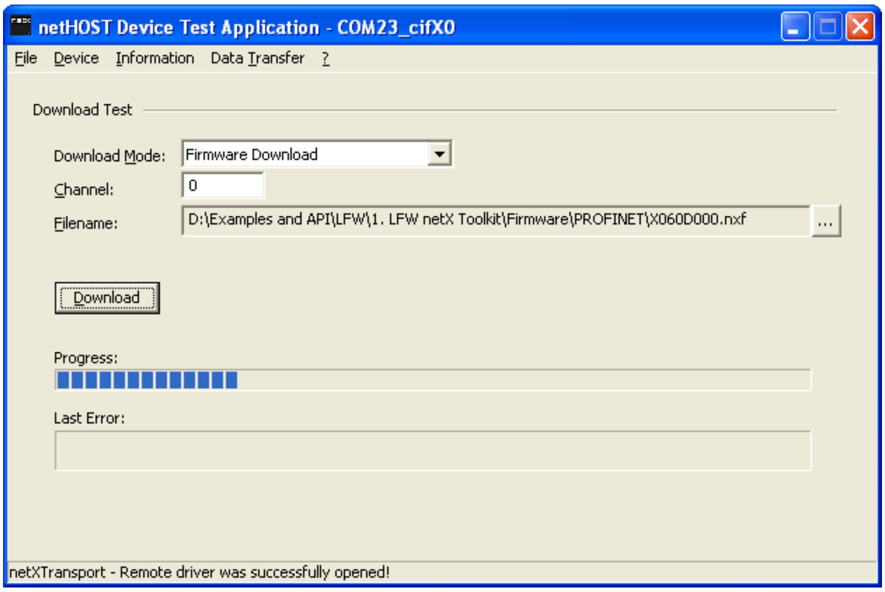
➢ In the Windows file selection dialog, select the firmware file which you want to download, then click **Open** button.

➾ The Windows file selection dialog closes, and back in the **Download** window, the selected Firmware file is displayed in the **Filename** field.

7. Download firmware file.

➢ Click **Download** button to start the file download.

➾ While the firmware file is being downloaded to the NXHX board, a progress bar is displayed:



netHOST Device Test Application - COM23_cifX0
File Device Information Data Transfer ?
Download Test
...
Download
Progress:
Last Error:

Download Mode: Firmware Download

Channel: 0

Filename: D:\Examples and API\LFW\1. LFW netX Toolkit\Firmware\PROFINET\X060D000.nxf

netXTransport - Remote driver was successfully opened!

Figure 56: Firmware Download in Progress

Note: A completed download is indicated only by the full progress bar; there will be no extra message box popping up in order to inform you about the completion of the download.

8. Reset NXHX board to start the firmware.

➢ Disconnect the USB cable from the NXHX board.

➢ Push the **Reset** button (T1) on the NXHX board (see position ⑲ in *Device Drawing and Positions of the NXHX 51-ETM* chapter on page 16).

⮩ The firmware is loaded by the Second Stage Bootloader. Running firmware is indicated by a steady green SYS LED (see position ⑱ in *Device Drawing and Positions of the NXHX 51-ETM* chapter on page 16)

➢ In the menu of the **netHOST Device Test Application**, choose **Device** > **Close**, then choose **File** > **Quit** to exit the application.

5.8 Downloading NXF Firmware via PCI and Host Interface

5.8.1 Overview

This section describes how to download a LFW or a LOM firmware in NXF format via the PCI interface of your development PC to the flash memory of your NXHX 51-ETM board via **Host Interface** by using the **cifX Driver Setup Utility** and the **NXPCA-PCI Adapter Board**.

For further information about the NXPCA-PCI board, please refer to the *User Manual NXPCA-PCI*.

A ready-made LFW PROFINET IO Device NXF firmware for testing and evaluation purposes (limited IO data exchange of 2 Bytes) is stored on the product DVD in the `Examples and API\LFW\1. LFW netX Toolkit\Firmware\PROFINET` directory.

As an alternative, you can also download the LOM PROFINET IO Device firmware in NXF format, which has also limited IO data exchange of 2 Bytes. Note that you first have to build it by using Waf with the **release** option. The code and libraries for this example are provided in the `Examples and API\LOM\2. LOM Build LFW` directory. After the build process, the firmware with the file name **LOM_PNS.nxf** will be stored in the `Examples and API\build\release\LOM\2. LOM Build LFW` directory.

5.8.2 Prerequisites

- Hilscher **NXPCA-PCI Adapter Board** (part number 7902.100).
- Hilscher **CAB-NXPCA-PCI** cable (part number 4400.000)
- You have installed the cifX Device Driver on your PC (on the NXHX 51-ETM product DVD, open the `Driver and Toolkit\Device Driver (NXDRV-WIN)\Installation` directory, then double-click **cifX Device Driver Setup.exe** file. Follow the instructions of the installation wizard).
- You have downloaded the **Second Stage Bootloader** to the NXHX board (see section *Downloading Executable Binary Image to Serial Flash of the NXHX 51-ETM via USB* on page 46).
- The NXHX board is connected to a voltage supply.
- You have access to the NXF firmware file which you want to download.

5.8.3 Step-by-Step Instructions

1. Install NXPCA-PCI Adapter Board in your development PC.

⚠ WARNING

Lethal Electrical Shock caused by parts with more than 50V!

First disconnect the power plug of the PC !
Make sure that the power supply is off at the PC !

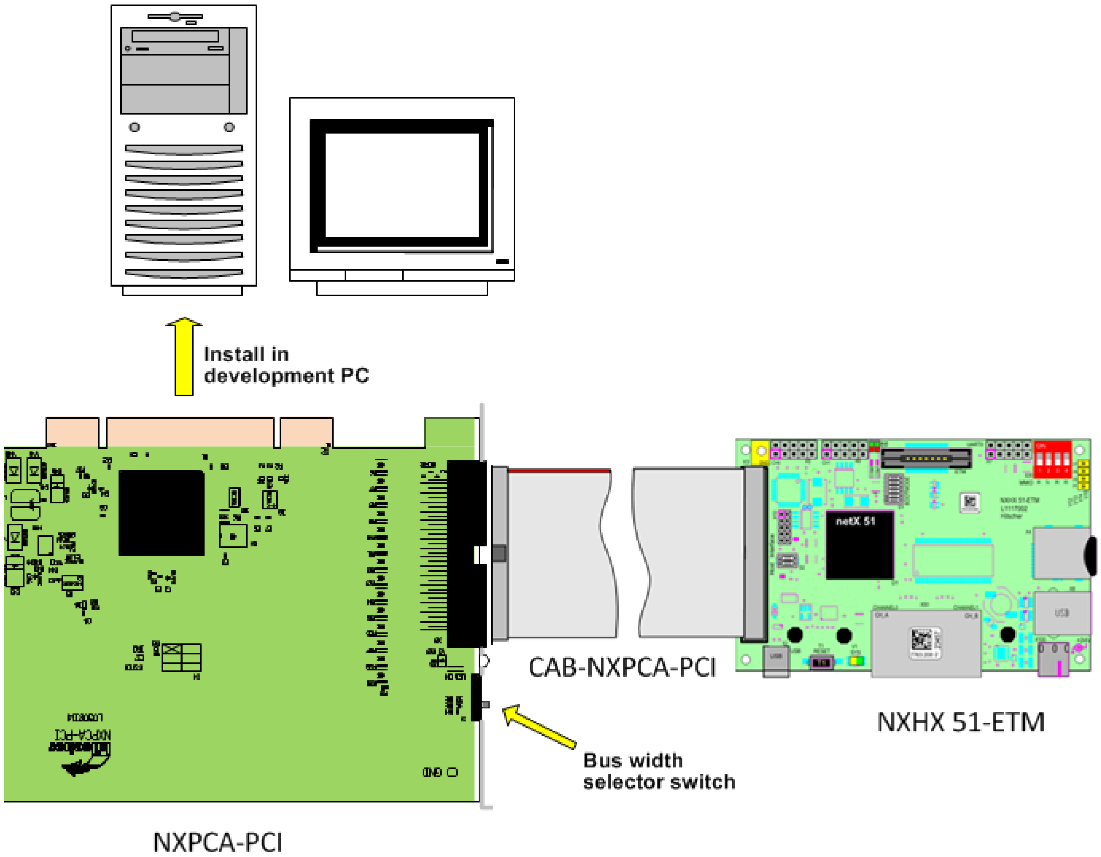


Figure 57: Connecting NXHX Board to PC via Adapter Board

- On the NXPCA-PCI board, set the bus width selector switch (located near the 68-pin DPM connector) to 16 Bit mode (middle position of slide switch).
- Open the housing of your development PC.
- Install the NXPCA-PCI adapter board at a free PCI interface slot of the PC.
- Close the housing of your development PC.

2. Connect NXHX 51-ETM board to NXPCA-PCI adapter board.

➢ Connect one end of the CAB-NXPCA-PCI cable to the 68-pin Dual-port memory connector of the NXPCA-PCI adapter board (accessible through cut-out slots in PC housing).

➢ Connect the other end of the CAB-NXPCA-PCI cable to the host interface connector X3 of the NXHX 51-ETM board (see position ㉑ in *Device Drawing and Positions of the NXHX 51-ETM* chapter on page 16).

➢ Reconnect your development PC to power supply and switch it on.

3. Finish installation of NXPCA-PCI adapter board under Windows.

After rebooting the development PC, Windows recognizes the new NXPCA-PCI hardware and wants to finish the installation of the appropriate driver.

If you are using Windows 7 or 8:

Under **Windows 7** and **8**, the **Installing device driver software** message appears in the Windows task bar. If you have already installed the cifX Device Driver on your PC (as recommended), Windows automatically copies the driver files to the appropriate Windows directories. You do not need to take any action in this.

If you are using Windows XP:

Under Windows XP, the **Found New Hardware Wizard** opens. If you have already installed the cifX Device Driver on your PC (as recommended), do the following:

➢ In the start screen of the **Found New Hardware Wizard**, answer the question **Can Windows connect to Windows Update…?** by selecting the **No, not this time** option.

➢ Click **Next** button.

➢ In the next screen, answer the question **What do you want the wizard to do?** by selecting **Install the software automatically** option.

➢ Click **Next**.

➥ Windows then copies the driver files to the Windows directories.

➢ In the **Completing the Found New Hardware Wizard** screen, click **Finish** button.

4. Configure NXHX board for DPM host interface mode.

- Use the S2 switch on the NXHX board (see position ㉒ in *Device Drawing and Positions of the NXHX 51-ETM* chapter on page 16) to set the host interface mode to **Parallel Dual-Port Memory 16 bit mode**. If you are using an NXHX 51-ETM board **hardware revision 3**, use the following settings:

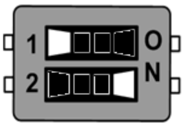
S2	SW	Setting
	1	off
	2	on

Table 6: 16 Bit Mode at Switch S2 for Hardware Revision 3

- If you are using an NXHX 51-ETM board **hardware revision 4**, use the following settings:

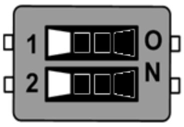
S2	SW	Setting
	1	off
	2	off

Table 7: 16 Bit Mode at Switch S2 for Hardware Revision 4

- Use the X10 Host Interface Configuration jumper on the NXHX board (see position ㉓ in *Device Drawing and Positions of the NXHX 51-ETM* chapter on page 16) to configure the signals for DPM host interface mode. Set the following jumper positions:

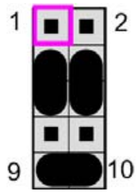
X10	Description
	DPM_DIRQ# signal is connected to X3 pin 11 DPM_SIRQ# signal is connected to X3 pin 4 RSTIN# signal is connected to X3 pin 7

Table 8: Set X10 Jumper for Dual-Port Memory

➾ The X10 host interface configuration jumper on the NXHX board should now look like this:

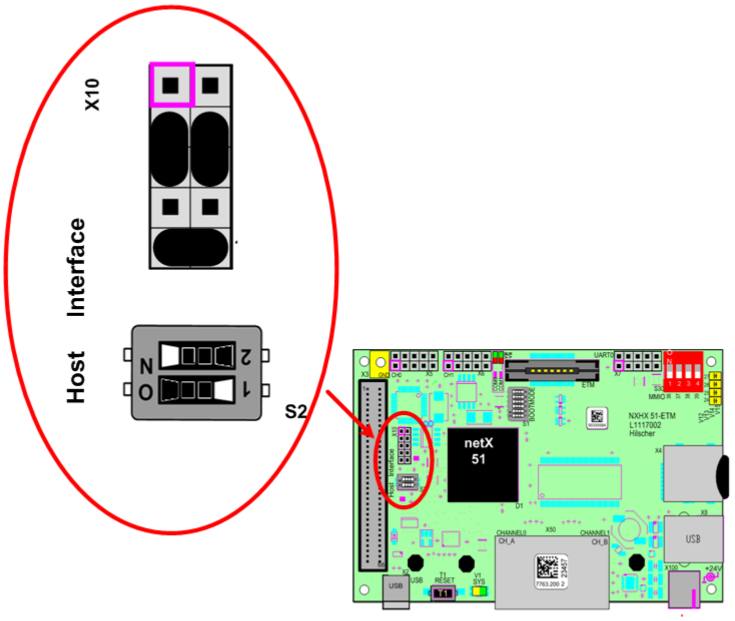


Figure 58: Settings for DPM

➢ Use the S1 switch on the NXHX board (see position ⑤ in *Device Drawing and Positions of the NXHX 51-ETM* chapter on page 16) to set the boot strap options to **FLASH boot mode**. Use the following settings:

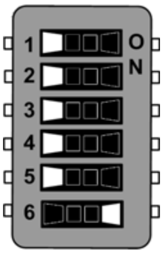
S1	SW	Setting
	1	off
	2	off
	3	off
	4	off
	5	off
	6	on

Table 9: Set Flash Boot Mode at Switch S1

5. Start the NXHX board.

➢ Connect the NXHX board to power supply or push the **Reset** button (T1) on the board (see position ⑲ in *Device Drawing and Positions of the NXHX 51-ETM* chapter on page 16).

➾ The Second Stage Bootloader is loaded and then runs in the internal RAM of the netX 51, searching for firmware to boot. This is indicated by the SYS LED (see position ⑱ in *Device Drawing and Positions of the NXHX 51-ETM* chapter on page 16) alternating between yellow and green.

6. Enable/disable the NXPCA-PCI driver before firmware download.

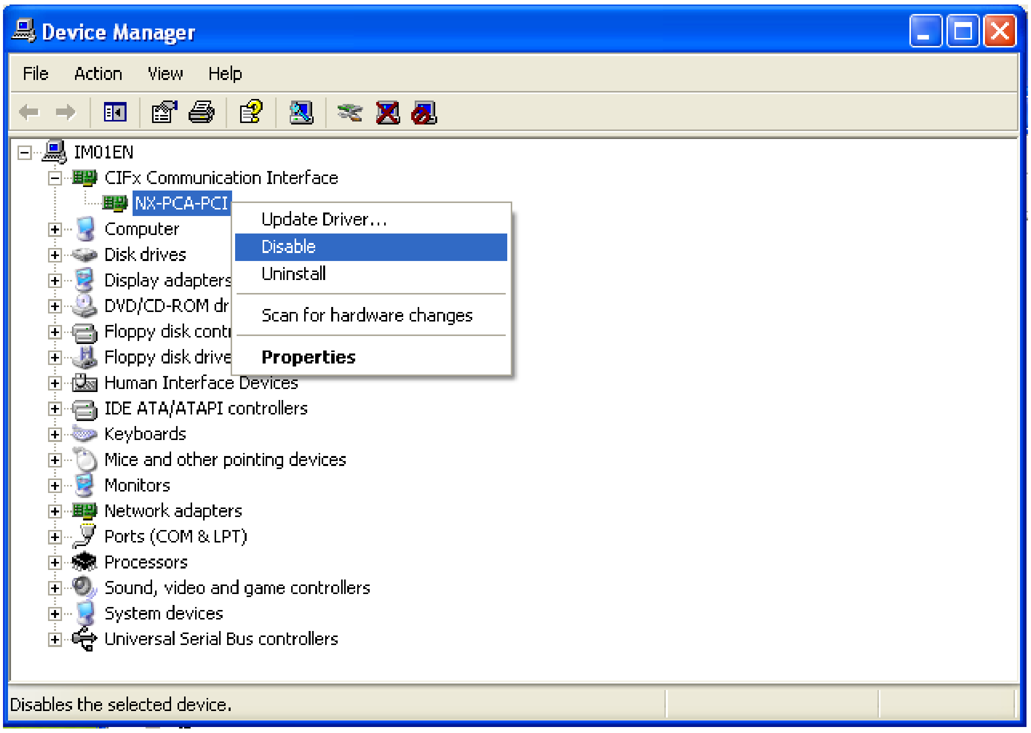
Before you can download the firmware file, you have to acquaint the Windows driver on your development PC with the new system channel in the Dual-Port Memory of the NXHX board, which has been established by the Second Stage Bootloader.

This can be achieved by enabling/disabling the **NXPCA-PCI driver** in the **Device Manager** of the PC:

➢ Open the **Device Manager** on your PC.
In Windows XP: **Start** menu > **Control Panel** > **System** > **Hardware** > **Device Manager**
In Windows 7 and 8: **Start** menu > **Control Panel** > **Hardware and Sound** > **Device Manager**

➢ In the **Device Manager**, click on the **+** Symbol in front of the **CIFx Communication Interface** entry, then right-click **NX-PCA-PCI** entry to open the context menu.

➢ In the context menu, select **Disable**.



Disables the selected device.

Figure 59: Disable NXPCA-PCI in Device Manager (Windows XP)

➩ A warning message appears.

➢ Acknowledge the warning message with **Yes**.

- ➢ Wait for a few seconds, then open the context menu on the **NX-PCA-PCI** entry again and select **Enable**.

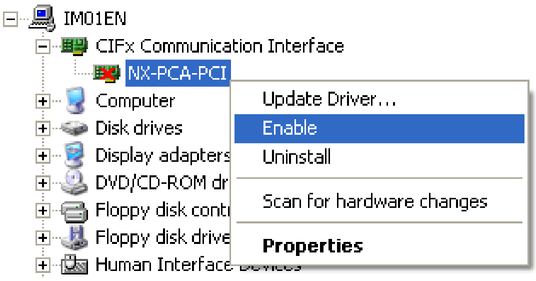


Figure 60: Enable NXPCA-PCI in Device Manager (Windows XP)

➩ You can now proceed to download the firmware.

7. Open cifX Driver Setup Utility on your PC.

If you are using Windows XP:

- ➢ In the **Start** menu, choose **Control Panel**.

➩ The **Control Panel** opens. Here you will see two cifX icons:

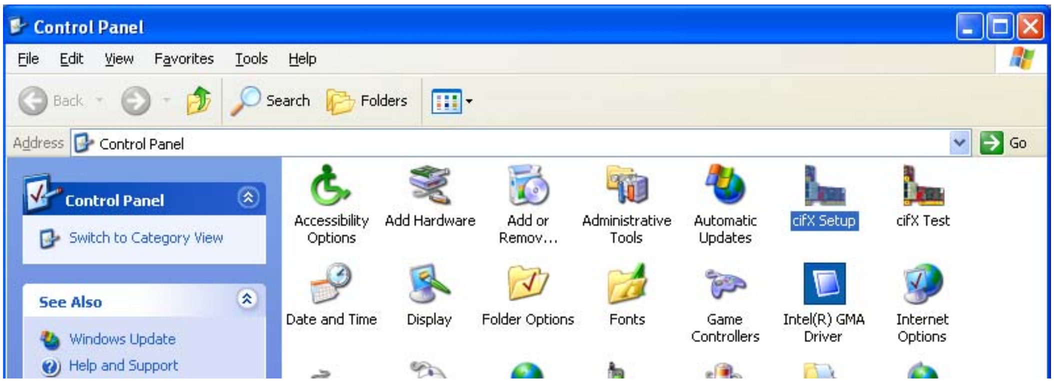


Figure 61: Control Panel in Windows XP

- ➢ Double-click **cifX Setup** icon.

If you are using Windows 7 or 8:

➢ In the **Start** menu, choose **Control Panel**.

➯ The **Control Panel** opens.

➢ In the navigation bar of the **Control Panel**, click on ▸ button and select **All Control Panel Items** entry.

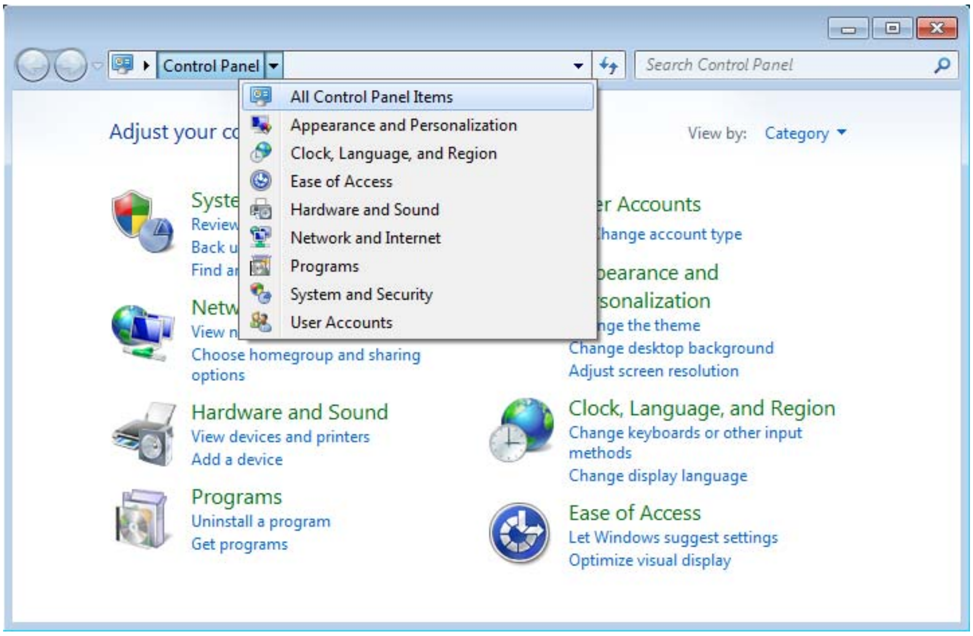


Figure 62: Control Panel in Windows 7

➯ The **All Control Panel Items** window opens:

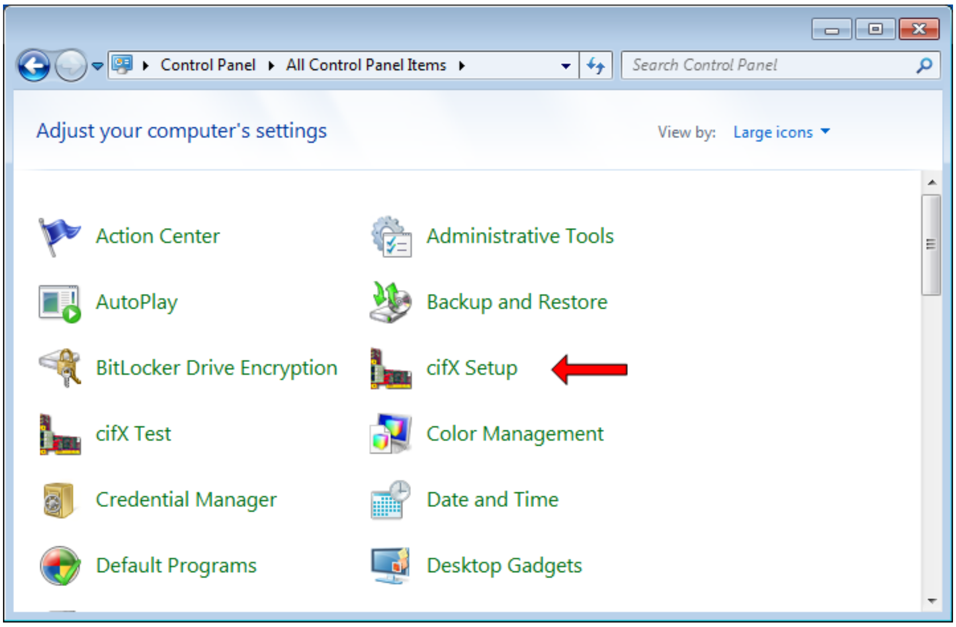
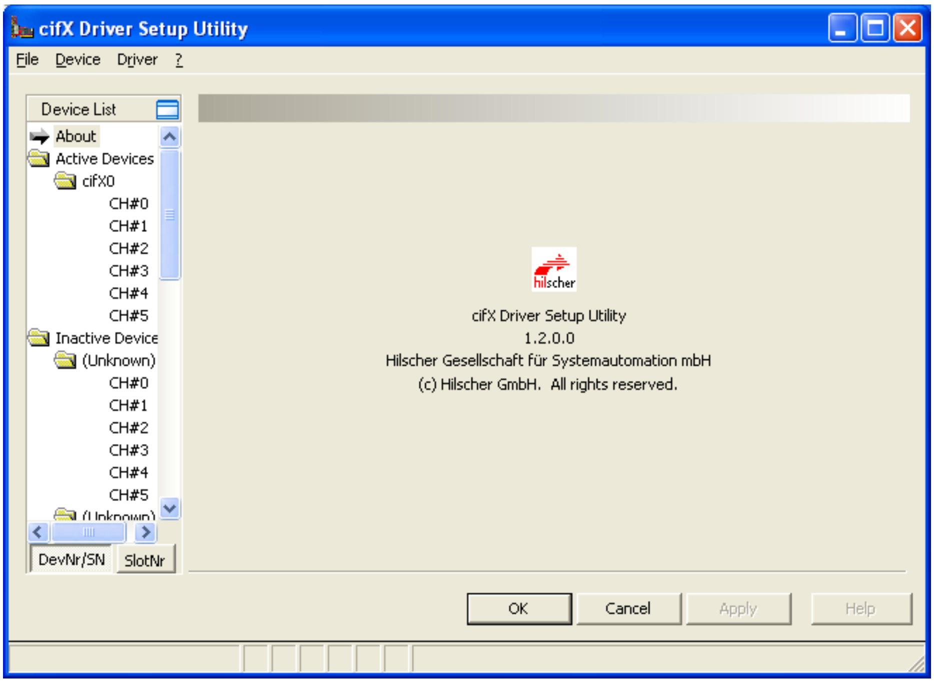


Figure 63:All Control Panel Items in Windows 7

➢ Double-click **cifX Setup** icon.

➢ Answer the question **Do you want to allow the following program to make changes to this computer** with Yes.

➮ The cifX Driver Setup Utility window opens:



cifX Driver Setup Utility
1.2.0.0
Hilscher Gesellschaft für Systemautomation mbH
(c) Hilscher GmbH. All rights reserved.

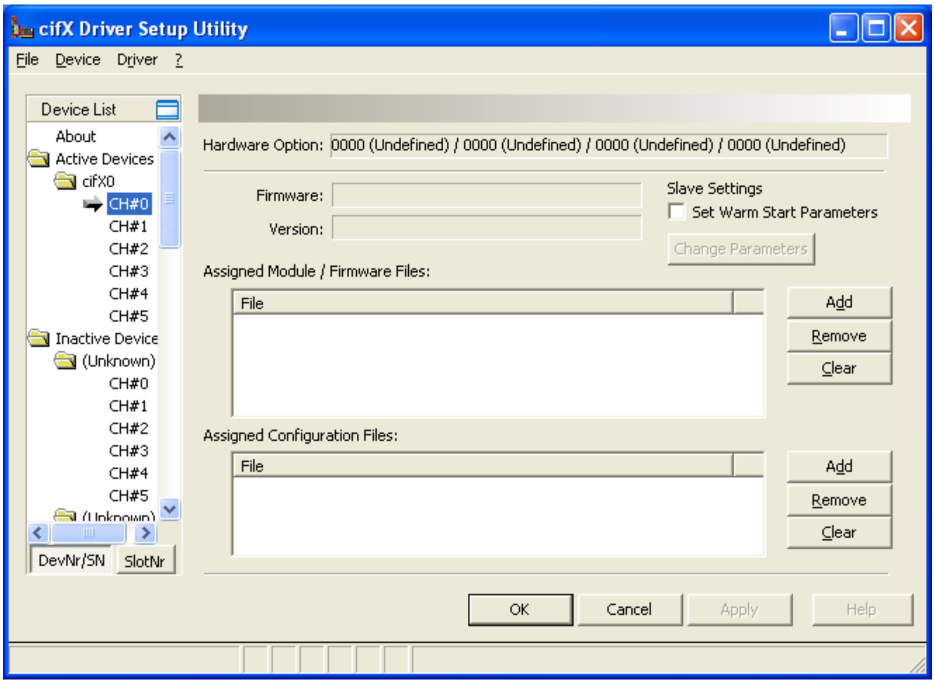
Figure 64: cifX Driver Setup Utility Start Screen

8. Select communication channel.

➢ In the **Device List**, in the folder **Active Devices > cifX0 ()**, click **CH#0** entry.

Note: A firmware and a configuration file can be assigned to each of the communication channels CH#0 to CH#5. By default, only channel CH#0 is used for firmware files in the `.nxf` format. The other channels are used for modular firmware files in the `.nxo` format.

➪ The following window is displayed:



Hardware Option: 0000 (Undefined) / 0000 (Undefined) / 0000 (Undefined) / 0000 (Undefined)

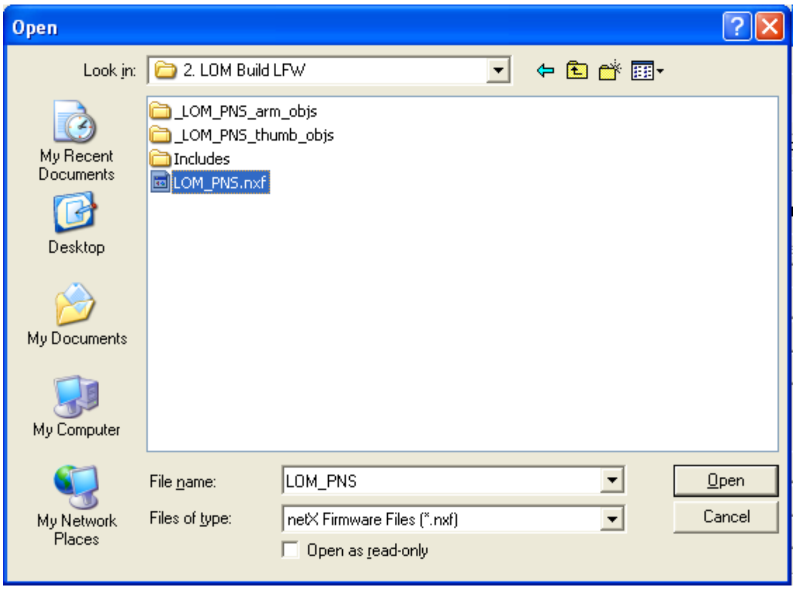
□ Set Warm Start Parameters

Figure 65: cifX Driver Setup Utility - Active Devices

9. Select firmware file.

➢ In the **Assigned Module / Firmware Files** area, click **Add** button.

➪ A file selection dialog window opens:



Look in: 2. LOM Build LFW

_LOM_PNS_arm_objs
_LOM_PNS_thumb_objs
Includes
LOM_PNS.nxf

File name: LOM_PNS

Files of type: netX Firmware Files (*.nxf)

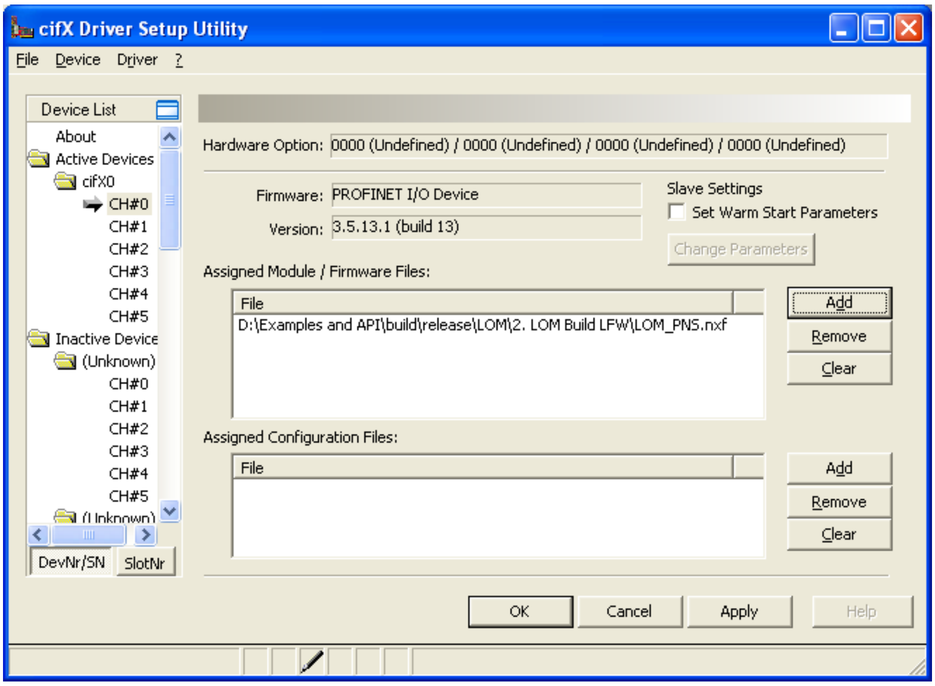
□ Open as read-only

Figure 66: cifX Driver Setup Utility – Open File Dialog

➢ Navigate to the directory where the NXF firmware is stored. If you want to use the LOM PROFINET IO Device firmware built with Waf, navigate to the `Examples and API\build\release\LOM\2. LOM Build LFW` directory and select the **LOM_PNS.nxf** file.
If you want to use the ready-made LFW PROFINET IO Device firmware (recommended) navigate to the `Examples and API\LFW\1. LFW netX Toolkit\Firmware\PROFINET` directory select the **X060D000.nxf** file.

➢ Click **Open** button.

➪ The selected Firmware file is displayed in the **Assigned Module / Firmware Files** field:



Hardware Option: 0000 (Undefined) / 0000 (Undefined) / 0000 (Undefined) / 0000 (Undefined)

Firmware: PROFINET I/O Device

Version: 3.5.13.1 (build 13)

□ Set Warm Start Parameters

Assigned Module / Firmware Files:

File
D:\Examples and API\build\release\LOM\2. LOM Build LFW\LOM_PNS.nxf

Assigned Configuration Files:

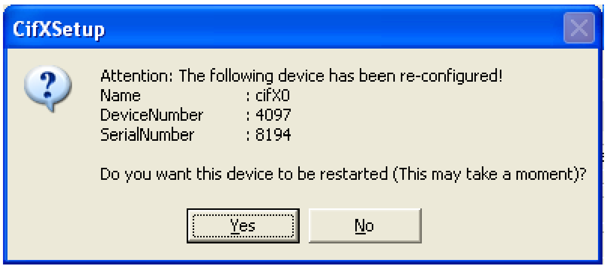
File

Figure 67: cifX Driver Setup Utility – Selected Firmware File

10. Download firmware file.

➢ Click **Apply** button to activate the file download (click **OK** button to download the file and also close the **cifX Driver Setup Utility**).

➪ A dialog box asking you to restart the NXHX board appears:



Attention: The following device has been re-configured!

Name	: cifX0
DeviceNumber	: 4097
SerialNumber	: 8194

Do you want this device to be restarted (This may take a moment)?

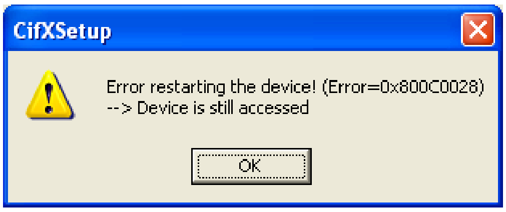
Figure 68: Device Restart Request

➢ Answer the request with **Yes**.

➪ The firmware file is downloaded to the NXHX board.

Note: The firmware file is also copied to the configuration directory on the development PC, e. g. `[disk drive]:\Program Files\cifX Device Driver\1250 100_999\Channel0\`.
This function is needed for netX devices without Flash memory, which boot from the PC via PCI, like e. g. cifX PC Cards.

- In case another program (e. g. SYCON.net or the cifX Test Application) is accessing the NXHX board at the same time during download, the following warning is displayed:



CifXSetup

Error restarting the device! (Error=0x800C0028)
--> Device is still accessed

Figure 69: Device Still Accessed Warning

- In this case, close the other program and repeat steps 9 and 10.

- On the NXHX board, the running firmware is indicated by a green SYS-LED (RDY/RUN).

Note: If you also want to download a configuration file, click **Add** button in the **Assigned Configuration Files** area to select the configuration file (`*.nxd`), then click **Apply** button to activate the download of the configuration file.

Enabling/disabling the NXPCA-PCI driver after firmware download

If you want to continue accessing the NXHX board from your PC via PCI interface after firmware download (i. e. for downloading a configuration or testing the IO data exchange), you again have to enable/disable the **NXPCA-PCI driver** in the **Device Manager** of your PC. This is because the Dual-Port Memory of the NXHX board has been changed by the firmware now running on the device.

For details on how to enable/disable the NXPCA-PCI driver, see step 6.

5.9 Configuring NXHX 51-ETM With SYCON.net

5.9.1 Overview

This section describes how to configure the NXHX board as PROFINET IO Device with the **SYCON.net** configuration software and how to download the configuration from the PC to the NXHX board via **Host Interface** and **NXPCA-PCI Adapter Board**. After configuration, you can test the I/O communication of the NXHX board.

Note: For effective configuration and testing of the NXHX board as PROFINET IO Device, you also need a PROFINET IO Controller. In this example, a Hilscher PC Card **CIFX 50 RE** is used as IO Controller.

5.9.2 Prerequisites

- You have downloaded the LFW PROFINET IO Device NXF firmware to the NXHX board (see *Downloading NXF Firmware to Serial Flash of the NXHX 51-ETM via USB* section on page 56 or *Downloading NXF Firmware via PCI and Host Interface* section on page 63).
- The NXHX board is connected to the configuration PC via **NXPCA-PCI Adapter Board** and **CAB-NXPCA-PCI** cable. Instructions for this can be found in the *Downloading NXF Firmware via PCI and Host Interface* section on page 63.
- You have installed the **SYCON.net** configuration software version 1.360 or higher on your PC (on the NXHX 51-ETM product DVD, open the `Software\SYCON.net` directory, then double-click **SYCONnet netX setup.exe** file. Follow the instructions of the installation wizard).
- You have installed the cifX Device Driver on your PC (on the NXHX 51-ETM product DVD, open the `Driver and Toolkit\Device Driver (NXDRV-WIN)\Installation` directory, then double-click **cifX Device Driver Setup.exe** file. Follow the instructions of the installation wizard).
- You have installed a PC Card **CIFX 50-RE** in your configuration PC. For details, please refer to the User Manual *PC Cards CIFX 50 50E 70E 100EH*, DOC120204UMxxEN.
- PROFINET IO Controller firmware for the PC Card CIFX 50-RE.
- The NXHX board is connected to a voltage supply.
- The NXHX board is connected to the PC Card CIFX 50-RE via Ethernet cable.

5.9.3 Step-by-Step Instructions

1. Enable Security Memory on the NXHX board.

➢ Use the S1 switch on the NXHX board (see position ⑤ in *Device Drawing and Positions of the NXHX 51-ETM* chapter on page 16) to enable the security memory and to set the boot strap options to **flash boot mode**. Use the following settings:

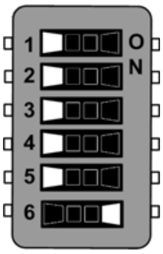
S1	SW	Setting
	1	off
	2	off
	3	off
	4	off
	5	off
	6	on

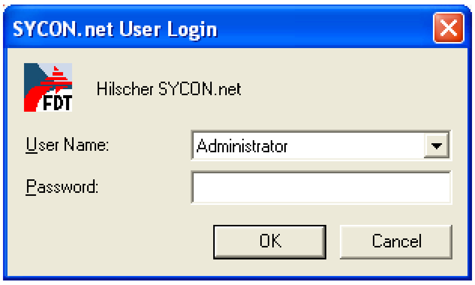
Table 10: Enable SecMem and Flash Boot Mode at Switch S1

➢ Push the **Reset** button (T1) on the NXHX board (see position ⑲ in *Device Drawing and Positions of the NXHX 51-ETM* chapter on page 16).

2. Start **SYCON.net** configuration software.

➢ In the Windows Start menu, select **All Programs** > **SYCON.net System Configurator** > **SYCON.net**.

➩ A login dialog appears:



Hilscher SYCON.net

User Name: Administrator

Password:

Figure 70: SYCON.net Login

➢ Enter your password, then click **OK**.

➯ SYCON.net opens with a new empty project:

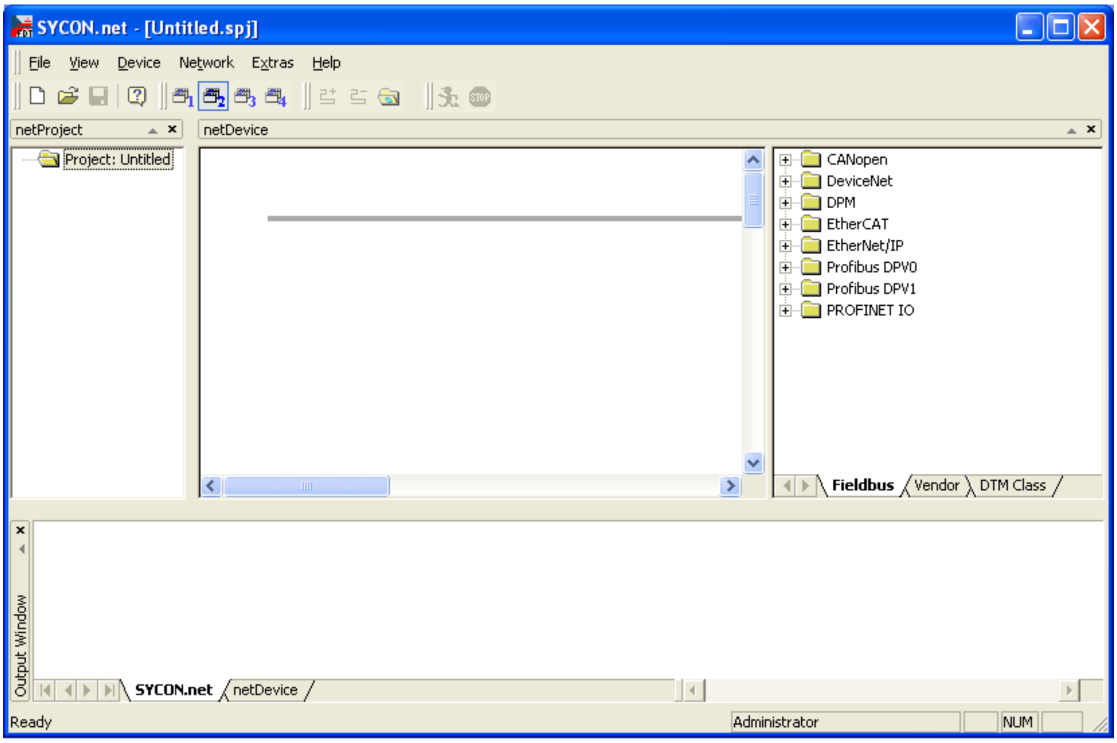


Figure 71: Empty Project in SYCON.net

3. Add PC Card cifX as PROFINET IO Controller (master).

➢ In the **Fieldbus** tab of the **Device Catalog** (right window), navigate to folder **PROFINET IO** > **Master**. Then select **CIFX RE/PNM** device and drag & drop it onto the bus configuration line in the middle window.

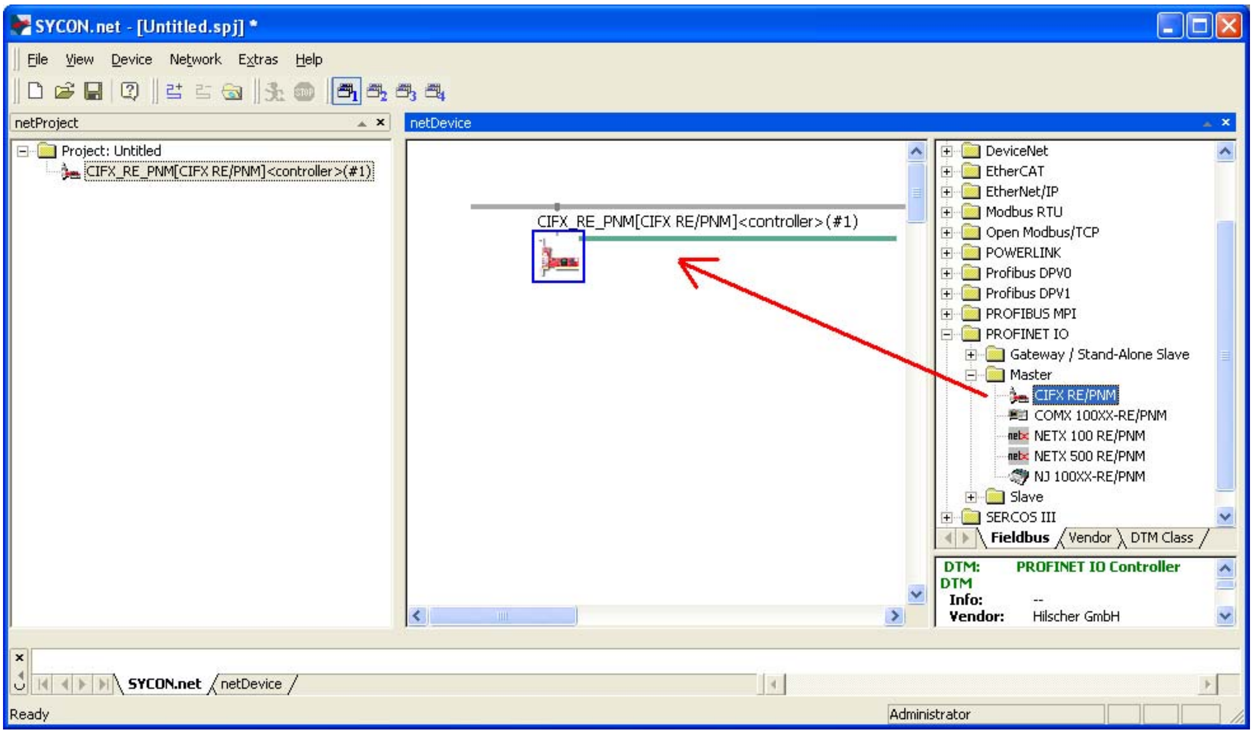


Figure 72: Define CIFX 50 as PROFINET IO Controller in SYCON.net

➩ The PC Card cifX is displayed on the bus line.

4. Add NXHX board as PROFINET IO Device (slave).

➢ In the **Fieldbus** tab of the **Device Catalog** (right window), navigate to folder **PROFINET IO** > **Gateway / Stand-Alone Slave**. Then select **NETX 51 RE/PNS** item and drag & drop it onto the PROFINET network line next to the PC Card cifX.

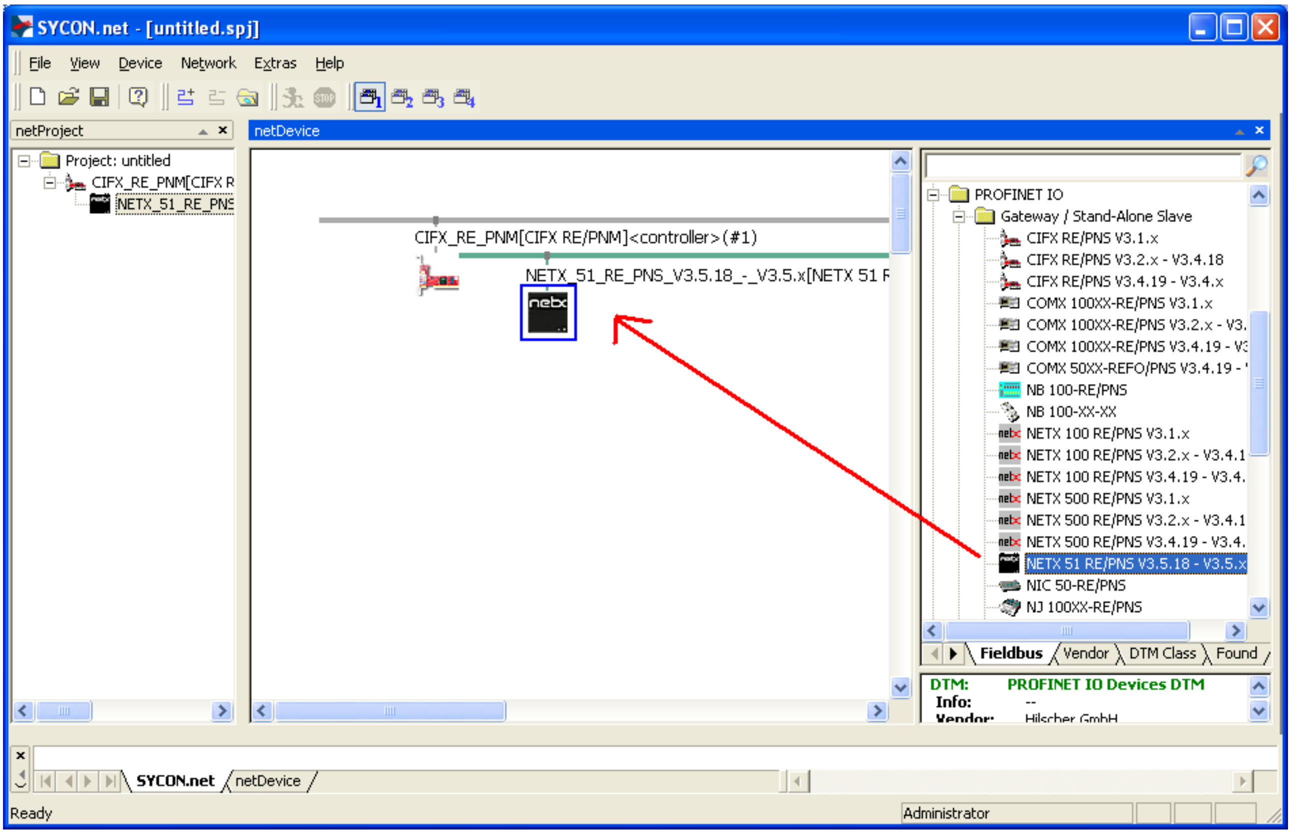

SYCON.net - [untitled.spj]
File View Device Network Extras Help
netProject
Project: untitled
CIFX_RE_PNM[CIFX R
NETX_51_RE_PNS
netDevice
CIFX_RE_PNM[CIFX RE/PNM]<controller>(#1)
NETX_51_RE_PNS_V3.5.18_-_V3.5.x[NETX 51 F
PROFINET IO
Gateway / Stand-Alone Slave
CIFX RE/PNS V3.1.x
CIFX RE/PNS V3.2.x - V3.4.18
CIFX RE/PNS V3.4.19 - V3.4.x
COMX 100XX-RE/PNS V3.1.x
COMX 100XX-RE/PNS V3.2.x - V3.
COMX 100XX-RE/PNS V3.4.19 - V3
COMX 50XX-REFO/PNS V3.4.19 - '
NB 100-RE/PNS
NB 100-XX-XX
NETX 100 RE/PNS V3.1.x
NETX 100 RE/PNS V3.2.x - V3.4.1
NETX 100 RE/PNS V3.4.19 - V3.4.
NETX 500 RE/PNS V3.1.x
NETX 500 RE/PNS V3.2.x - V3.4.1
NETX 500 RE/PNS V3.4.19 - V3.4.
NETX 51 RE/PNS V3.5.18 - V3.5.x
NIC 50-RE/PNS
NJ 100XX-RE/PNS
Fieldbus
Vendor
DTM Class
Found
DTM: PROFINET IO Devices DTM
Info: --
Vendor: Hilscher GmbH
SYCON.net
netDevice
Ready
Administrator

Figure 73: Define NXHX Board as PROFINET IO Device in SYCON.net

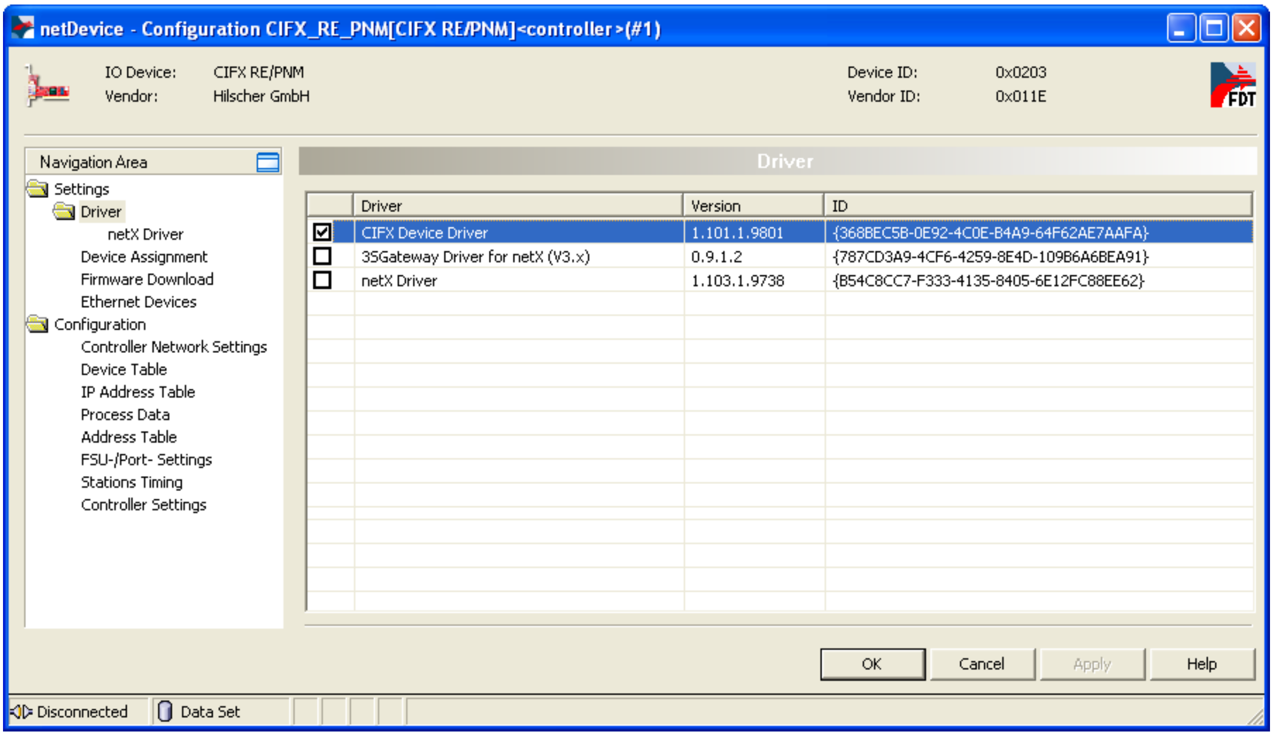
➩ You have added the NXHX board as IO Device (slave) in the PROFINET IO network.

5. Assign driver to PC Card cifX (IO Controller).

➢ Double-click the **CIFX_RE_PNM** symbol (i. e. the IO Controller) in the bus configuration line or select the symbol and choose **Configuration…** entry from the context menu.

➩ The **Configuration** dialog window opens.

- ➢ In the **Navigation Area**, select **Settings** > **Driver**.
- ➩ The **Driver** list opens:



netDevice - Configuration CIFX_RE_PNM[CIFX RE/PNM]<controller>(#1)

IO Device: CIFX RE/PNM
Vendor: Hilscher GmbH
Device ID: 0x0203
Vendor ID: 0x011E

Driver

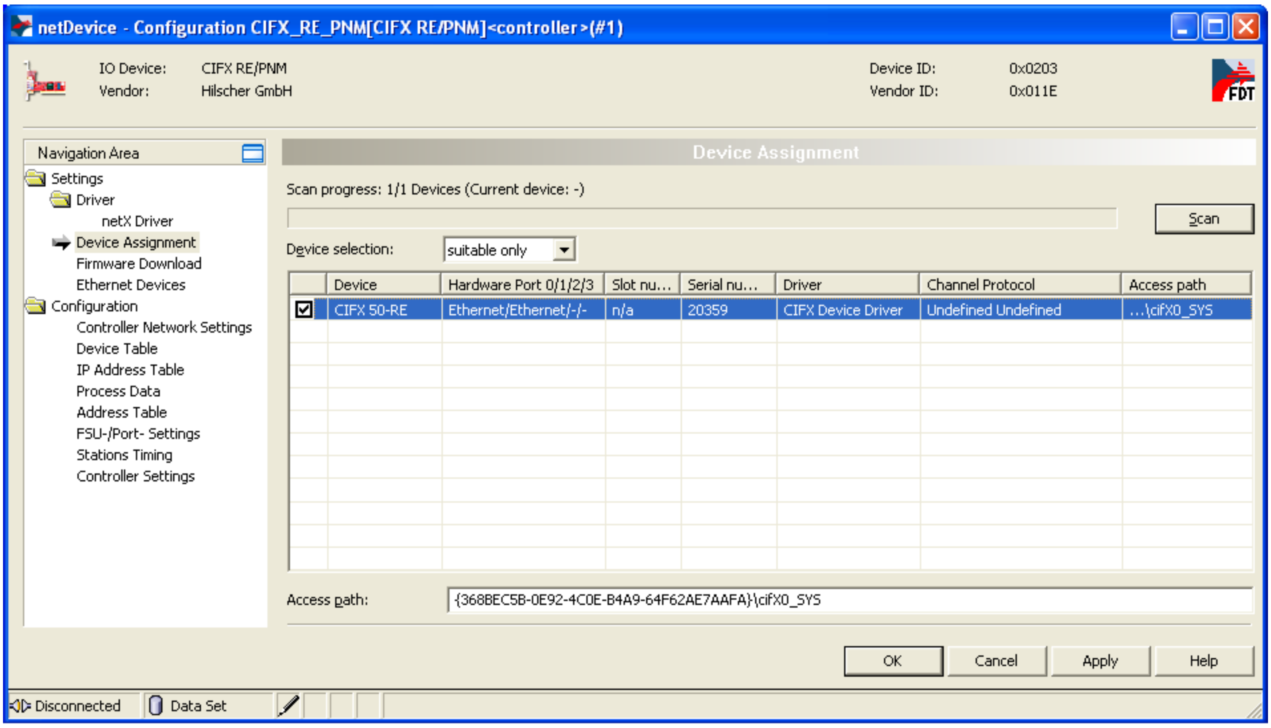
	Driver	Version	ID
☑	CIFX Device Driver	1.101.1.9801	{368BEC5B-0E92-4C0E-B4A9-64F62AE7AAFA}
□	3SGateway Driver for netX (V3.x)	0.9.1.2	{787CD3A9-4CF6-4259-8E4D-109B6A6BEA91}
□	netX Driver	1.103.1.9738	{B54C8CC7-F333-4135-8405-6E12FC88EE62}

Figure 74: Choose Driver for PC Card cifX

- ➢ Check the box in front of the **cifX Device Driver** entry and click **Apply** button.
- ➢ In the **Navigation Area**, select **Settings** > **Driver** > **Device Assignment**.

➮ The **Device Assignment** window opens.

➢ Check the box in front of the **CIFX 50-RE** entry and click **Apply** button.



netDevice - Configuration CIFX_RE_PNM[CIFX RE/PNM]<controller>(#1)

IO Device: CIFX RE/PNM
Vendor: Hilscher GmbH
Device ID: 0x0203
Vendor ID: 0x011E

Device Assignment

Scan progress: 1/1 Devices (Current device: -)

Device selection: suitable only

	Device	Hardware Port 0/1/2/3	Slot nu...	Serial nu...	Driver	Channel Protocol	Access path
☑	CIFX 50-RE	Ethernet/Ethernet/-/-	n/a	20359	CIFX Device Driver	Undefined Undefined	...\cifX0_SYS

Access path: {368BEC5B-0E92-4C0E-B4A9-64F62AE7AAFA}\cifX0_SYS

Figure 75: Assign Driver to PC Card cifX

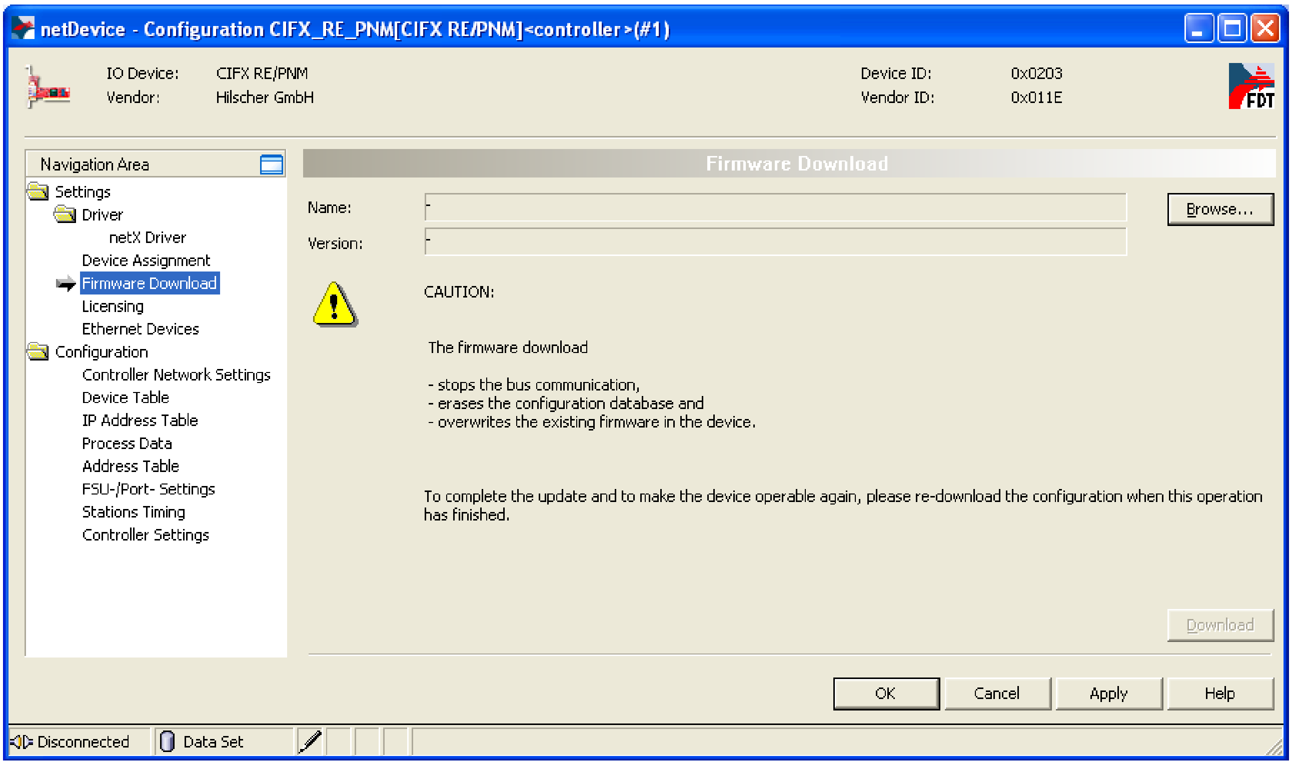
➮ You have assigned the driver for the PC Card cifX.

6. Download IO Controller firmware to PC Card cifX.

Note: This step has to be performed only if no PROFINET IO Controller firmware has yet been loaded to the PC card cifX. If the PC Card cifX is already equipped with a PROFINET IO Controller firmware, you can skip this step and close the configuration dialog window for the PC Card cifX by clicking the **OK** button.

➢ In the **Navigation Area**, select **Settings** > **Driver** > **Firmware Download**.

➪ The **Firmware Download** window opens:



IO Device: CIFX RE/PNM
Vendor: Hilscher GmbH
Device ID: 0x0203
Vendor ID: 0x011E

Name:
Version:

CAUTION:

The firmware download

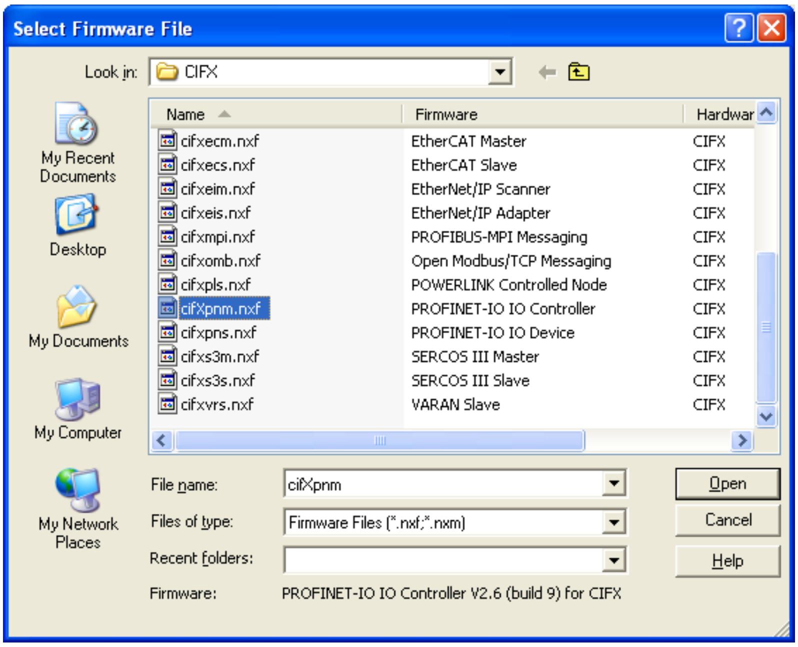
- stops the bus communication,
- erases the configuration database and
- overwrites the existing firmware in the device.

To complete the update and to make the device operable again, please re-download the configuration when this operation has finished.

Figure 76: Firmware Download Dialog in SYCON.net

➢ Click **Browse…** button to choose the firmware which you want to load into the PC Card cifX.

➪ The **Select Firmware File** dialog opens:



Look in: CIFX

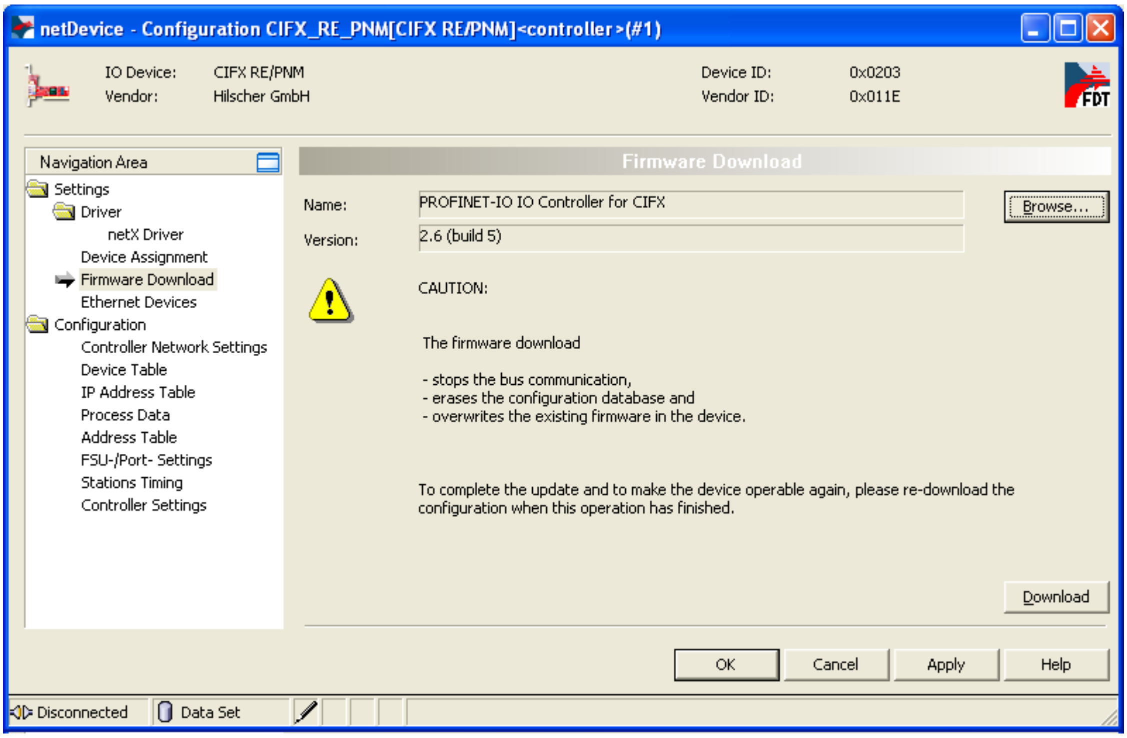
Name	Firmware	Hardwar
cifxecm.nxf	EtherCAT Master	CIFX
cifxecs.nxf	EtherCAT Slave	CIFX
cifxeim.nxf	EtherNet/IP Scanner	CIFX
cifxeis.nxf	EtherNet/IP Adapter	CIFX
cifxmpi.nxf	PROFIBUS-MPI Messaging	CIFX
cifxomb.nxf	Open Modbus/TCP Messaging	CIFX
cifxpls.nxf	POWERLINK Controlled Node	CIFX
cifXpnm.nxf	PROFINET-IO IO Controller	CIFX
cifxpns.nxf	PROFINET-IO IO Device	CIFX
cifxs3m.nxf	SERCOS III Master	CIFX
cifxs3s.nxf	SERCOS III Slave	CIFX
cifxvrs.nxf	VARAN Slave	CIFX

File name: cifXpnm
Files of type: Firmware Files (*.nxf;*.nxm)
Recent folders:
Firmware: PROFINET-IO IO Controller V2.6 (build 9) for CIFX

Figure 77: Select Firmware File Dialog in SYCON.net

➢ Navigate to the directory where the PROFINET IO Controller firmware is stored. On the Communication Solutions DVD e.g., this is the `Firmware\CIFX` folder.

- ➢ Select **cifXpnm.nxf** file, then click **Open** button.
- ➩ Name and version of the selected firmware are displayed in the **Firmware Download** window.



netDevice - Configuration CIFX_RE_PNM[CIFX RE/PNM]<controller>(#1)

IO Device: CIFX RE/PNM
Vendor: Hilscher GmbH
Device ID: 0x0203
Vendor ID: 0x011E

Navigation Area
- Settings
  - Driver
    - netX Driver
  - Device Assignment
  - Firmware Download
  - Ethernet Devices
- Configuration
  - Controller Network Settings
  - Device Table
  - IP Address Table
  - Process Data
  - Address Table
  - FSU-/Port- Settings
  - Stations Timing
  - Controller Settings

Firmware Download

Name: PROFINET-IO IO Controller for CIFX
Version: 2.6 (build 5)

CAUTION:

The firmware download

- stops the bus communication,
- erases the configuration database and
- overwrites the existing firmware in the device.

To complete the update and to make the device operable again, please re-download the configuration when this operation has finished.

Figure 78: Downloading Firmware to PC Card cifX

- ➢ Check, whether you have selected the right firmware, then click **Download** button to start the download. Answer the security question with **Yes**.
- ➩ The firmware is downloaded to the PC Card cifX.
- ➢ Click **OK** button to close the configuration window.

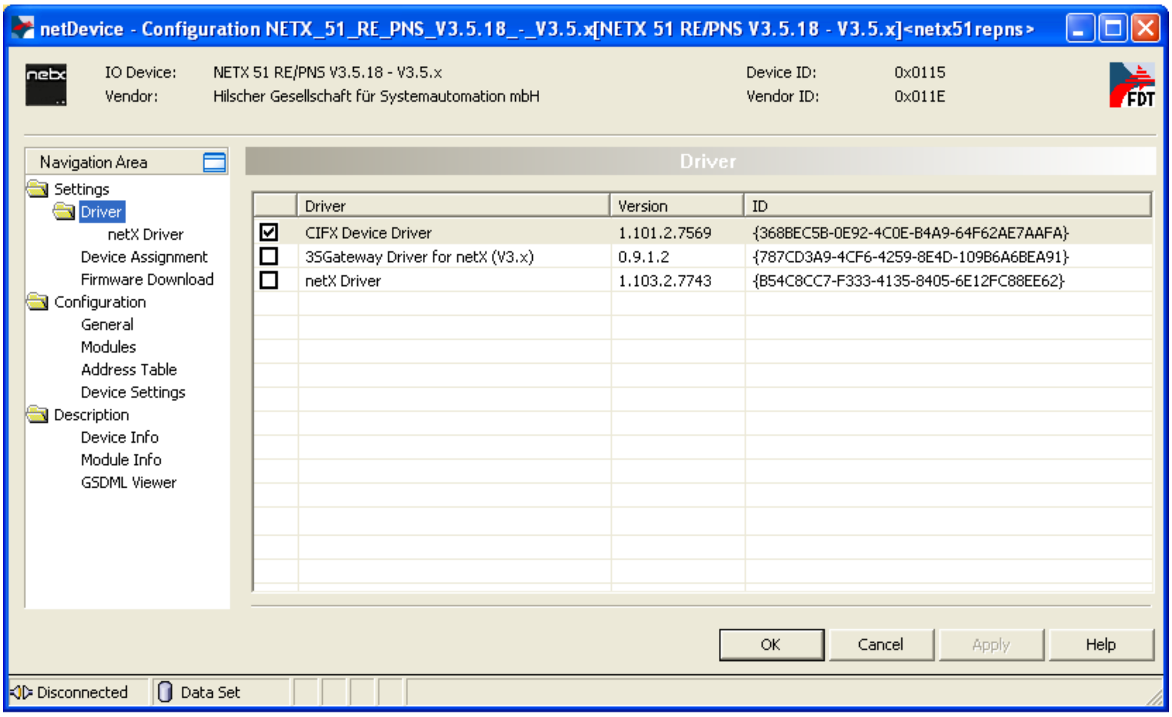
7. Assign driver to NXHX board (IO Device).

➢ Double-click the NETX_51_ RE_PNS symbol (i. e. the IO Device) in the bus configuration line or select the symbol and choose **Configuration…** entry from the context menu.

➯ The **Configuration** dialog opens.

➢ In the **Navigation Area**, select **Settings** > **Driver**.

➯ The **Driver** list opens:



netDevice - Configuration NETX_51_RE_PNS_V3.5.18_-_V3.5.x[NETX 51 RE/PNS V3.5.18 - V3.5.x]<netx51repns>

IO Device: NETX 51 RE/PNS V3.5.18 - V3.5.x

Vendor: Hilscher Gesellschaft für Systemautomation mbH

Device ID: 0x0115

Vendor ID: 0x011E

Driver

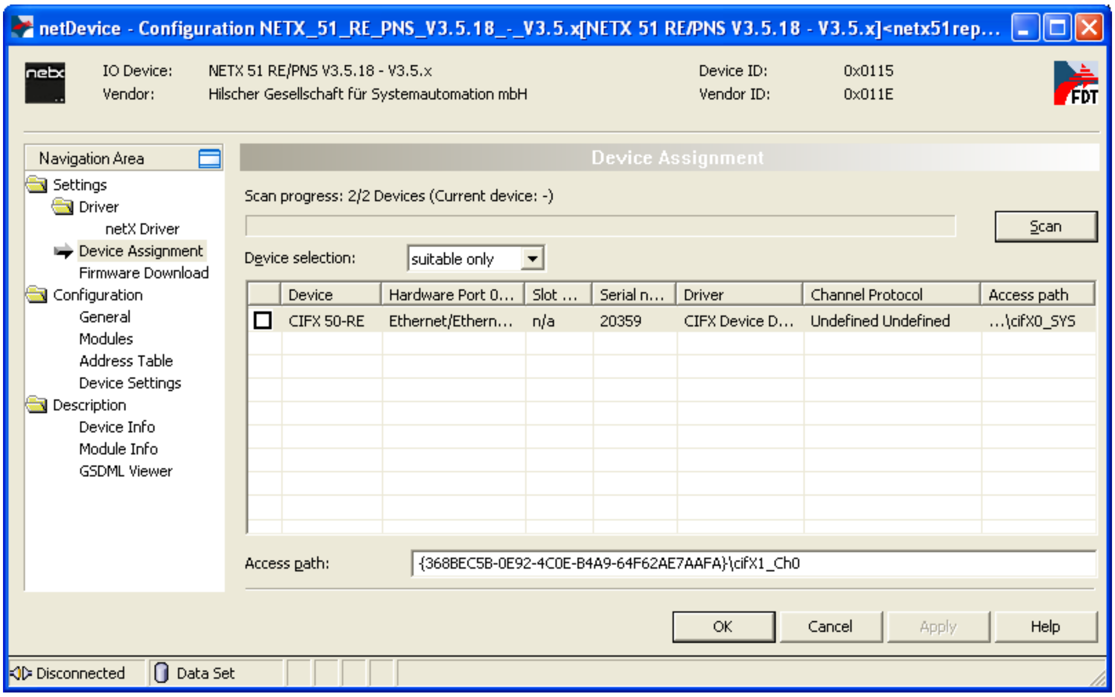
	Driver	Version	ID
☑	CIFX Device Driver	1.101.2.7569	{368BEC5B-0E92-4C0E-B4A9-64F62AE7AAFA}
☐	3SGateway Driver for netX (V3.x)	0.9.1.2	{787CD3A9-4CF6-4259-8E4D-109B6A6BEA91}
☐	netX Driver	1.103.2.7743	{B54C8CC7-F333-4135-8405-6E12FC88EE62}

Figure 79: Choose Driver for NXHX Board

➢ Check the box in front of the **cifX Device Driver** entry and click **Apply** button.

- ➢ In the **Navigation Area**, select **Settings** > **Driver** > **Device Assignment**.

➯ The **Device Assignment** dialog window opens:



netDevice - Configuration NETX_51_RE_PNS_V3.5.18_-_V3.5.x[NETX 51 RE/PNS V3.5.18 - V3.5.x]<netx51rep...

IO Device: NETX 51 RE/PNS V3.5.18 - V3.5.x
Vendor: Hilscher Gesellschaft für Systemautomation mbH
Device ID: 0x0115
Vendor ID: 0x011E

Device Assignment

Scan progress: 2/2 Devices (Current device: -)

Device selection: suitable only

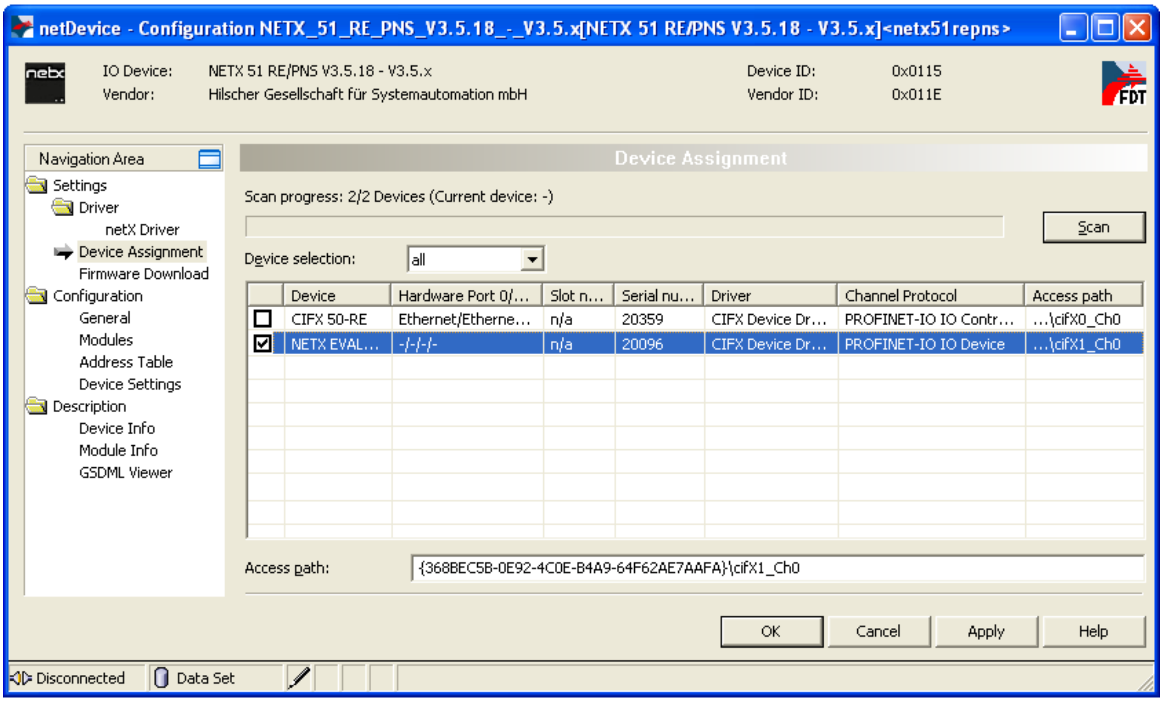
	Device	Hardware Port 0...	Slot ...	Serial n...	Driver	Channel Protocol	Access path
☐	CIFX 50-RE	Ethernet/Ethern...	n/a	20359	CIFX Device D...	Undefined Undefined	...\cifX0_SYS

Access path: {368BEC5B-0E92-4C0E-B4A9-64F62AE7AAFA}\cifX1_Ch0

Figure 80: Configuration Dialog NXHX Board

- ➢ In the **Device Assignment** dialog window, choose **all** in the **Device selection** drop-down list, then click **Scan** button.

- SYCON.net scans for connected devices. If the NXHX board has been properly connected to the configuration PC, the NXHX board will be found and displayed as NETX EVALUATION BOARD in the list:



netDevice - Configuration NETX_51_RE_PNS_V3.5.18_-_V3.5.x[NETX 51 RE/PNS V3.5.18 - V3.5.x]<netx51repns>

IO Device: NETX 51 RE/PNS V3.5.18 - V3.5.x
Vendor: Hilscher Gesellschaft für Systemautomation mbH
Device ID: 0x0115
Vendor ID: 0x011E

Device Assignment

Scan progress: 2/2 Devices (Current device: -)

Device selection: all

	Device	Hardware Port 0/...	Slot n...	Serial nu...	Driver	Channel Protocol	Access path
□	CIFX 50-RE	Ethernet/Etherne...	n/a	20359	CIFX Device Dr...	PROFINET-IO IO Contr...	...\cifX0_Ch0
☑	NETX EVAL...	-/-/-/-	n/a	20096	CIFX Device Dr...	PROFINET-IO IO Device	...\cifX1_Ch0

Access path: {368BEC5B-0E92-4C0E-B4A9-64F62AE7AAFA}\cifX1_Ch0

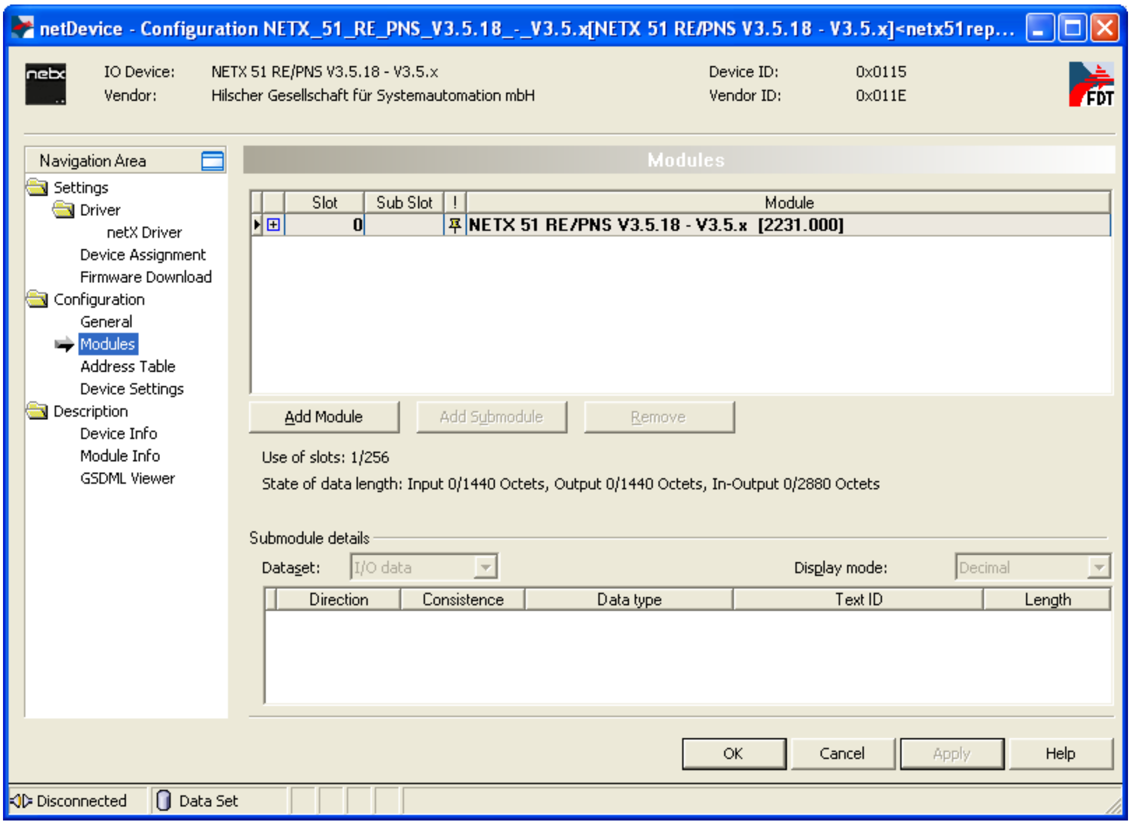
Figure 81: Assign Driver to NXHX Board

- Check the box in front of the NETX EVALUATION BOARD entry and click **Apply** button.
- You have assigned the driver for the NXHX board.

8. Configure I/O data of NXHX board.

➢ In the **Navigation Area**, select **Configuration** > **Modules**.

➾ The **Modules** dialog window opens:



netDevice - Configuration NETX_51_RE_PNS_V3.5.18_-_V3.5.x[NETX 51 RE/PNS V3.5.18 - V3.5.x]<netx51rep...

IO Device: NETX 51 RE/PNS V3.5.18 - V3.5.x
Vendor: Hilscher Gesellschaft für Systemautomation mbH
Device ID: 0x0115
Vendor ID: 0x011E

Modules

	Slot	Sub Slot	!	Module
⊞	0			NETX 51 RE/PNS V3.5.18 - V3.5.x [2231.000]

Use of slots: 1/256

State of data length: Input 0/1440 Octets, Output 0/1440 Octets, In-Output 0/2880 Octets

Submodule details

Dataset: I/O data
Display mode: Decimal

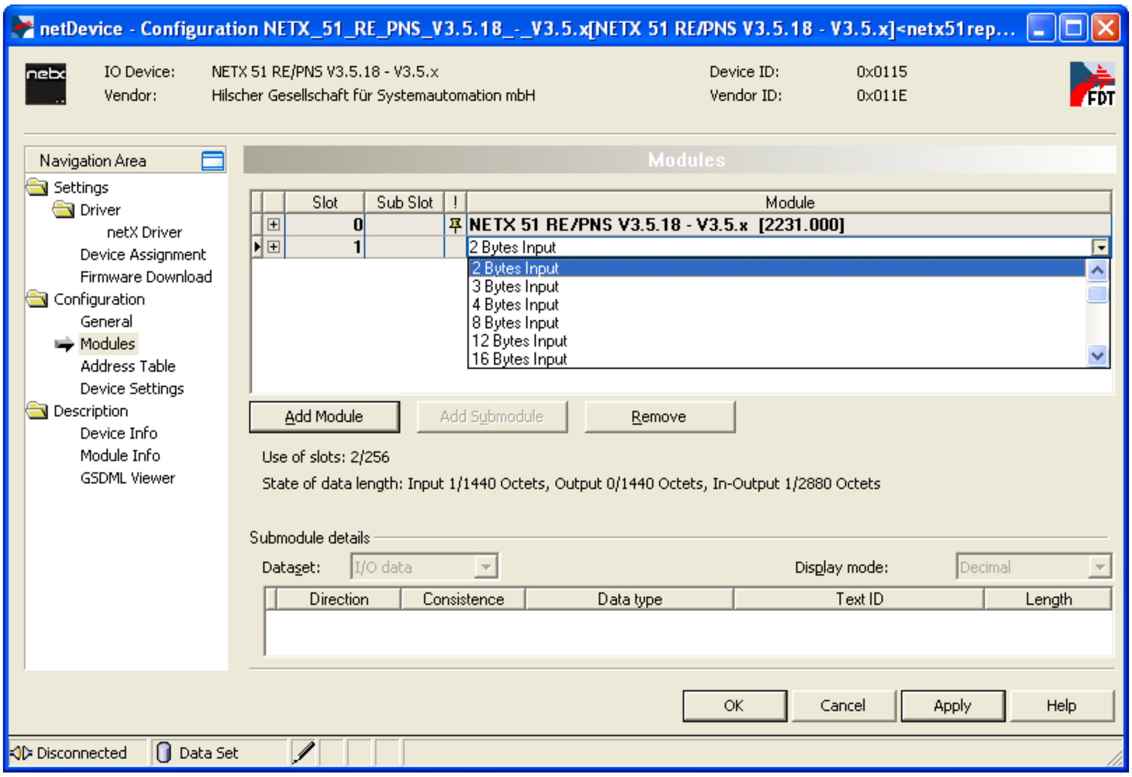
Direction	Consistence	Data type	Text ID	Length

Figure 82: Modules Dialog of NXHX Board

➢ Click **Add Module** button to add a module for input data.

Note: The PROFINET IO Device firmware for testing and evaluation purposes is limited to two Bytes IO data exchange.

- ➢ Click in the **Module** field of the newly added module, then select **2 Bytes Input** from the drop-down list.



netDevice - Configuration NETX_51_RE_PNS_V3.5.18_-_V3.5.x[NETX 51 RE/PNS V3.5.18 - V3.5.x]<netx51rep...

IO Device: NETX 51 RE/PNS V3.5.18 - V3.5.x
Vendor: Hilscher Gesellschaft für Systemautomation mbH
Device ID: 0x0115
Vendor ID: 0x011E

Slot	Sub Slot	!	Module
0			NETX 51 RE/PNS V3.5.18 - V3.5.x [2231.000]
1			2 Bytes Input

2 Bytes Input
3 Bytes Input
4 Bytes Input
8 Bytes Input
12 Bytes Input
16 Bytes Input

Use of slots: 2/256

State of data length: Input 1/1440 Octets, Output 0/1440 Octets, In-Output 1/2880 Octets

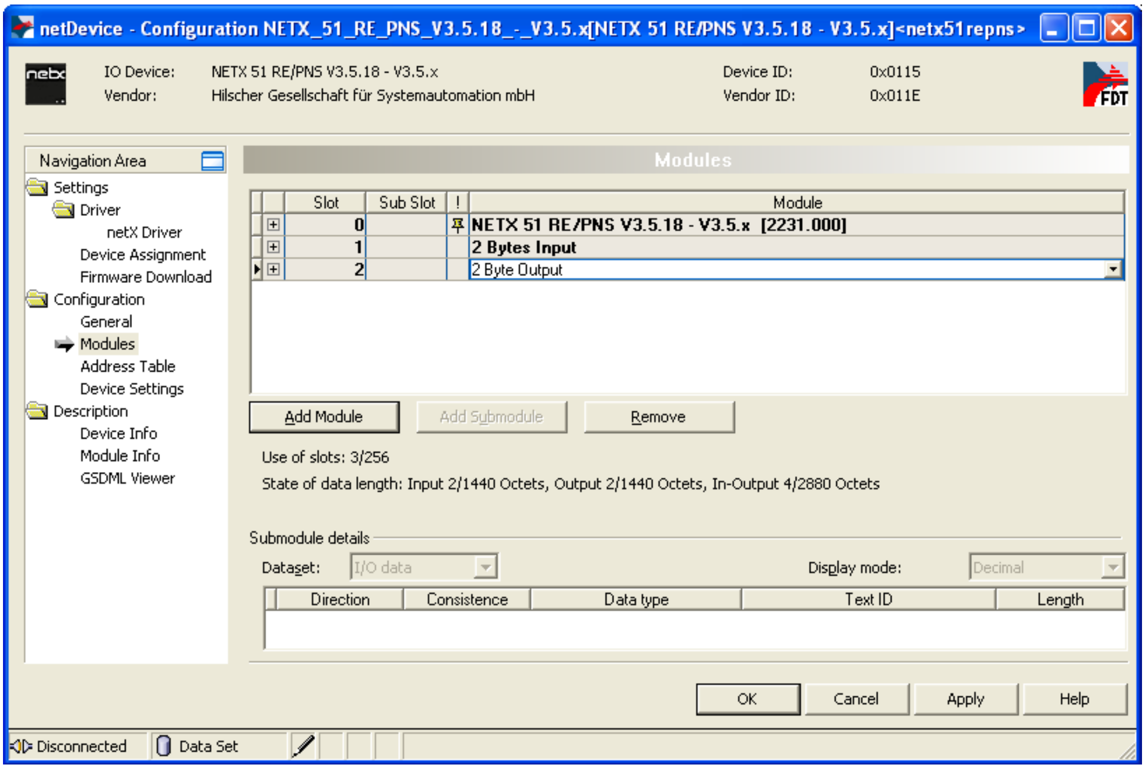
Submodule details

Dataset: I/O data   Display mode: Decimal

Direction	Consistence	Data type	Text ID	Length

Figure 83: Define Input Module of NXHX Board

- ➢ Click **Add Module** button again to add a module for output data.
- ➢ Click in the **Module** field of the newly added module, then select **2 Byte Output** from the drop-down list.



netDevice - Configuration NETX_51_RE_PNS_V3.5.18_-_V3.5.x[NETX 51 RE/PNS V3.5.18 - V3.5.x]<netx51repns>

IO Device: NETX 51 RE/PNS V3.5.18 - V3.5.x
Vendor: Hilscher Gesellschaft für Systemautomation mbH
Device ID: 0x0115
Vendor ID: 0x011E

Slot	Sub Slot	!	Module
0			NETX 51 RE/PNS V3.5.18 - V3.5.x [2231.000]
1			2 Bytes Input
2			2 Byte Output

Use of slots: 3/256

State of data length: Input 2/1440 Octets, Output 2/1440 Octets, In-Output 4/2880 Octets

Submodule details

Dataset: I/O data   Display mode: Decimal

Direction	Consistence	Data type	Text ID	Length

Figure 84: Define Output Module of NXHX Board

➢ Click **OK** button to close the configuration dialog.

➾ You have configured the I/O data of the NXHX board.

9. Download configuration to NXHX board.

➢ Select the **NETX_51_RE_PNS** symbol and use the right mouse button to open the context menu.

➢ In the context menu, select **Download**.

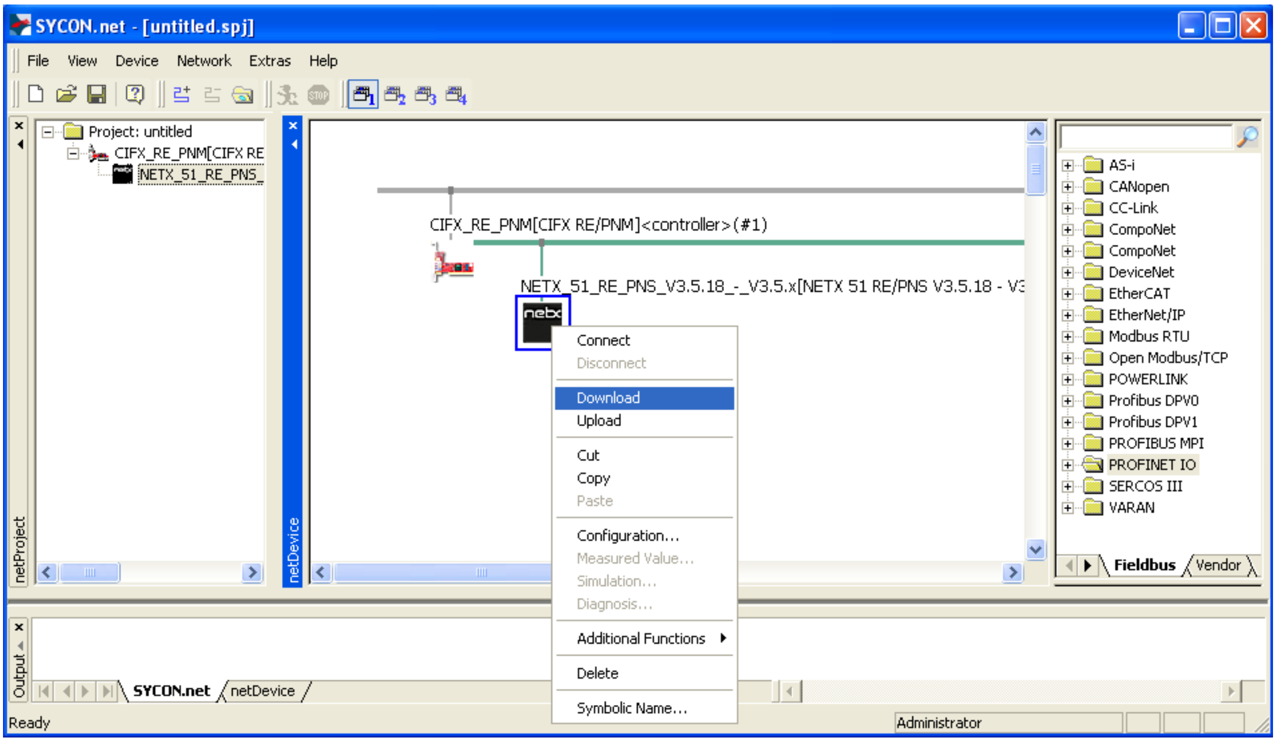


Figure 85: Download Configuration to NXHX Board

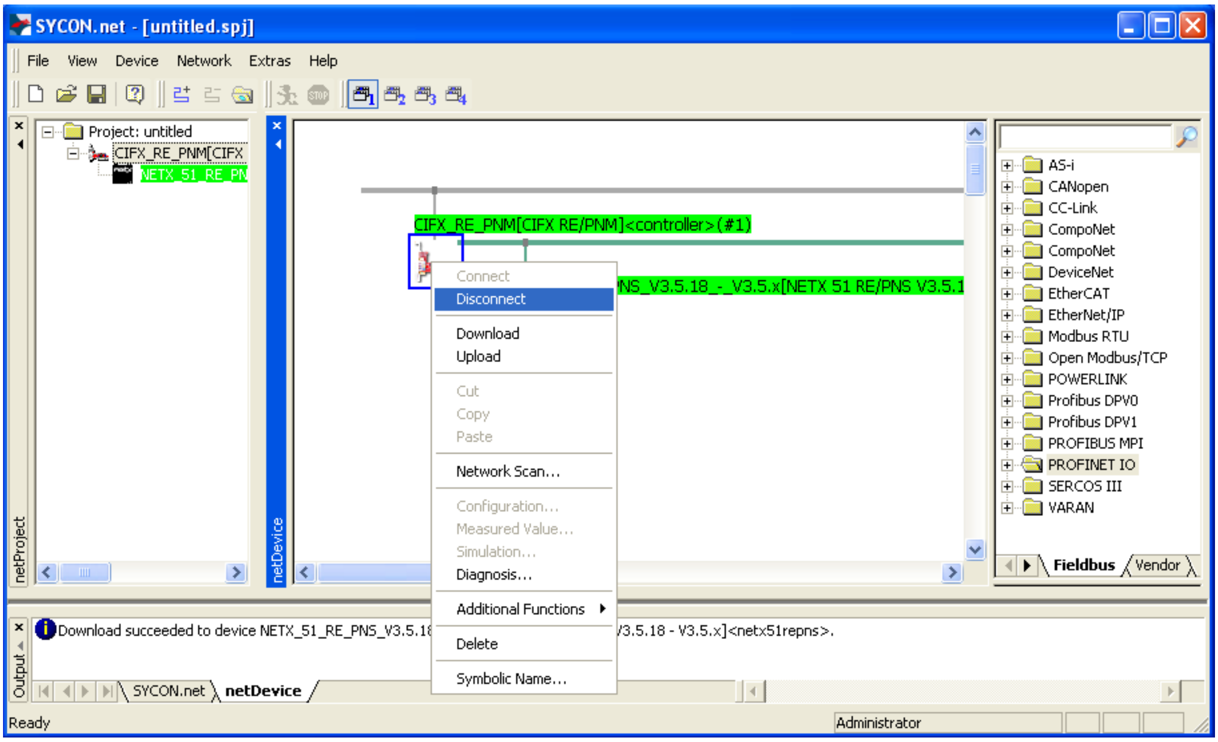
➢ Answer the configuration download confirmation request with **Yes**.

➾ The configuration is downloaded to the NXHX board.
SYCON.net automatically establishes an online connection for both NXHX board (IO Device) and the PC Card cifX (IO Controller). The communication status LED **COM 1** on the NXHX board shows steady red light (see position ④ in *Device Drawing and Positions of the NXHX 51-ETM* chapter on page 16). This is because the configuration of the PC Card cifX (IO Controller) has not been downloaded yet, thus IO Controller and IO Device are not communicating yet.

10. Configure PC Card cifX (IO Controller).

Note: You don’t necessarily need to configure the PC Card cifX (IO Controller), because this example can be used with the configuration parameters preset by SYCON.net. You can, however, customize the configuration of the PC Card cifX (IO Controller), if you want to use a different network setup, e. g. if you are using additional slave devices.

- ➢ Select the **CIFX_RE_PNM** symbol and use the right mouse button to open the context menu.
- ➢ In the context menu, select **Disconnect**.

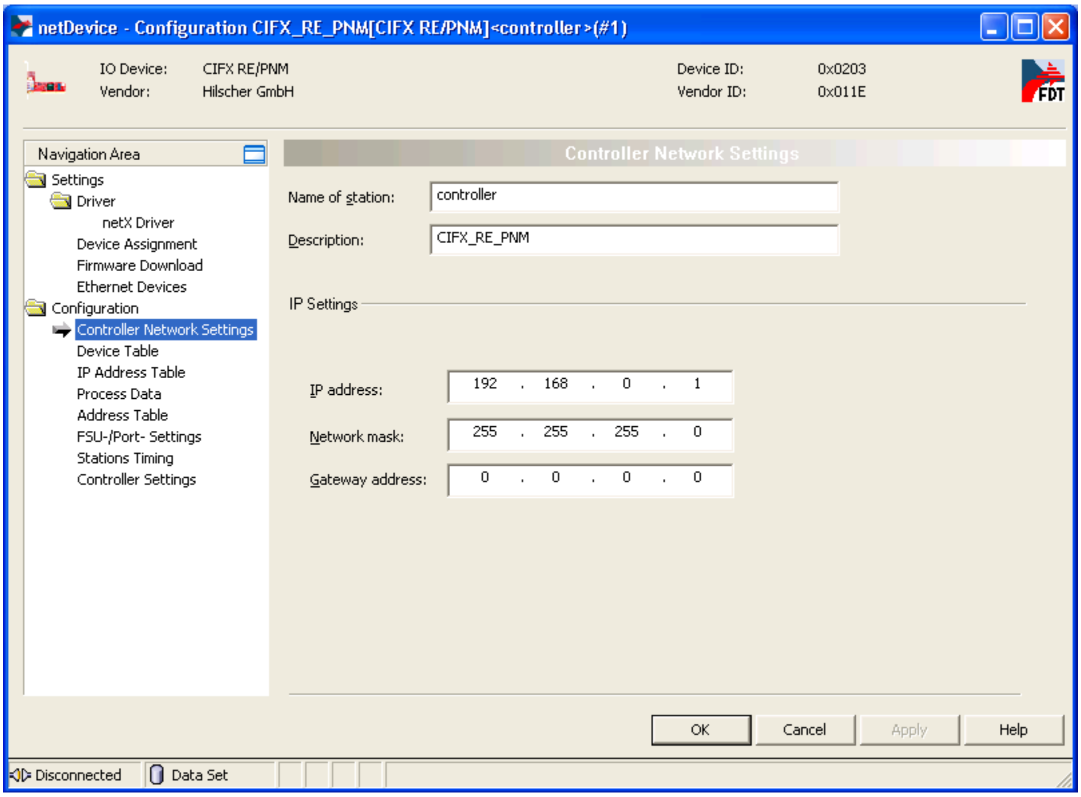


Download succeeded to device NETX_51_RE_PNS_V3.5.18 /3.5.18 - V3.5.x]<netx51repns>.

Figure 86: Disconnect IO Controller in SYCON.net

- ⇨ SYCON.net disconnects the online connection to the PC Card cifX (IO Controller). The PC Card cifX (IO Controller) can now be configured.
- ➢ Double-click the **CIFX_RE_PNM** symbol (i. e. the IO Controller) in the bus configuration line or select the symbol and choose **Configuration…** entry from the context menu.
- ⇨ The **Configuration** dialog window opens.

- ➢ In the **Navigation Area**, choose **Configuration** > **Controller Network Settings**.
- ➩ The **Controller Network Settings** dialog window opens:



netDevice - Configuration CIFX_RE_PNM[CIFX RE/PNM]<controller>(#1)

IO Device: CIFX RE/PNM
Vendor: Hilscher GmbH
Device ID: 0x0203
Vendor ID: 0x011E

Controller Network Settings

Name of station: controller

Description: CIFX_RE_PNM

IP Settings

IP address: 192 . 168 . 0 . 1

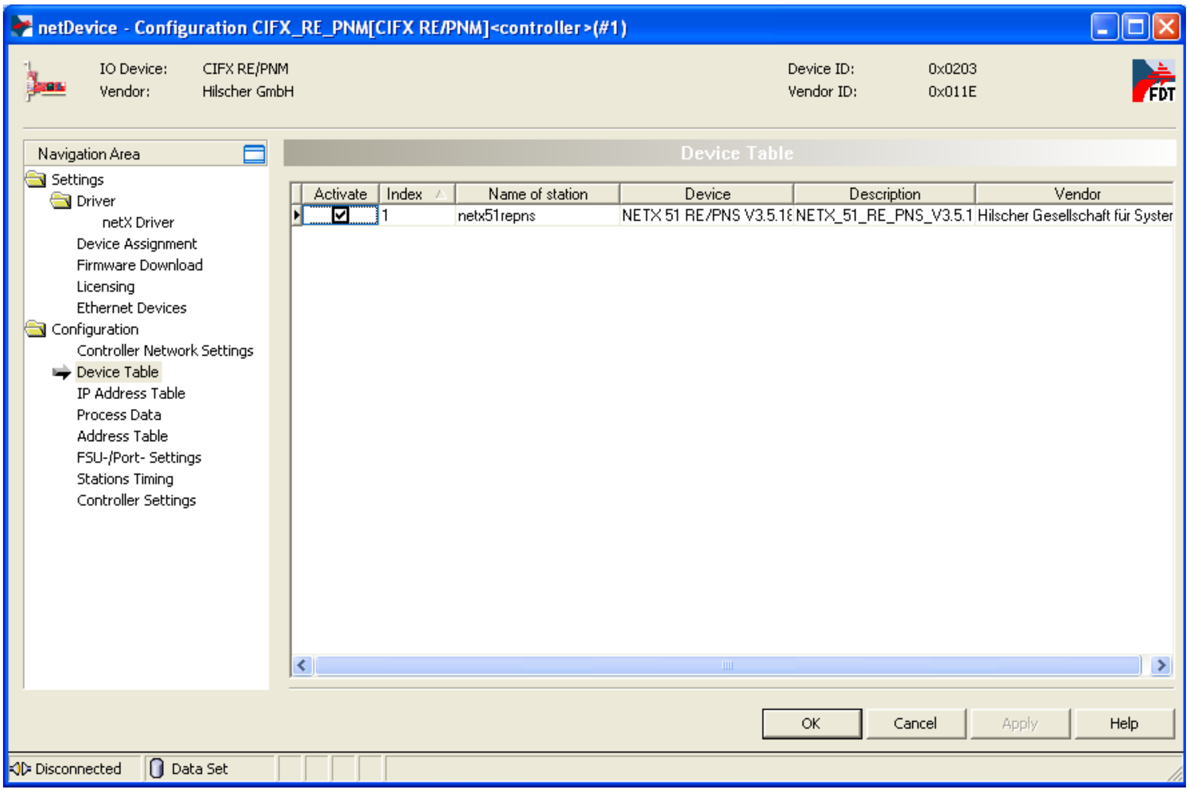
Network mask: 255 . 255 . 255 . 0

Gateway address: 0 . 0 . 0 . 0

Figure 87: Controller Network Settings

- ➢ Alter the station name and the IP address of the IO Controller, if you need to.

- ➢ In the **Navigation Area**, choose **Configuration** > **Device Table**.
- ➾ The **Device Table** dialog window opens:



netDevice - Configuration CIFX_RE_PNM[CIFX RE/PNM]<controller>(#1)

IO Device:	CIFX RE/PNM	Device ID:	0x0203
Vendor:	Hilscher GmbH	Vendor ID:	0x011E

Device Table

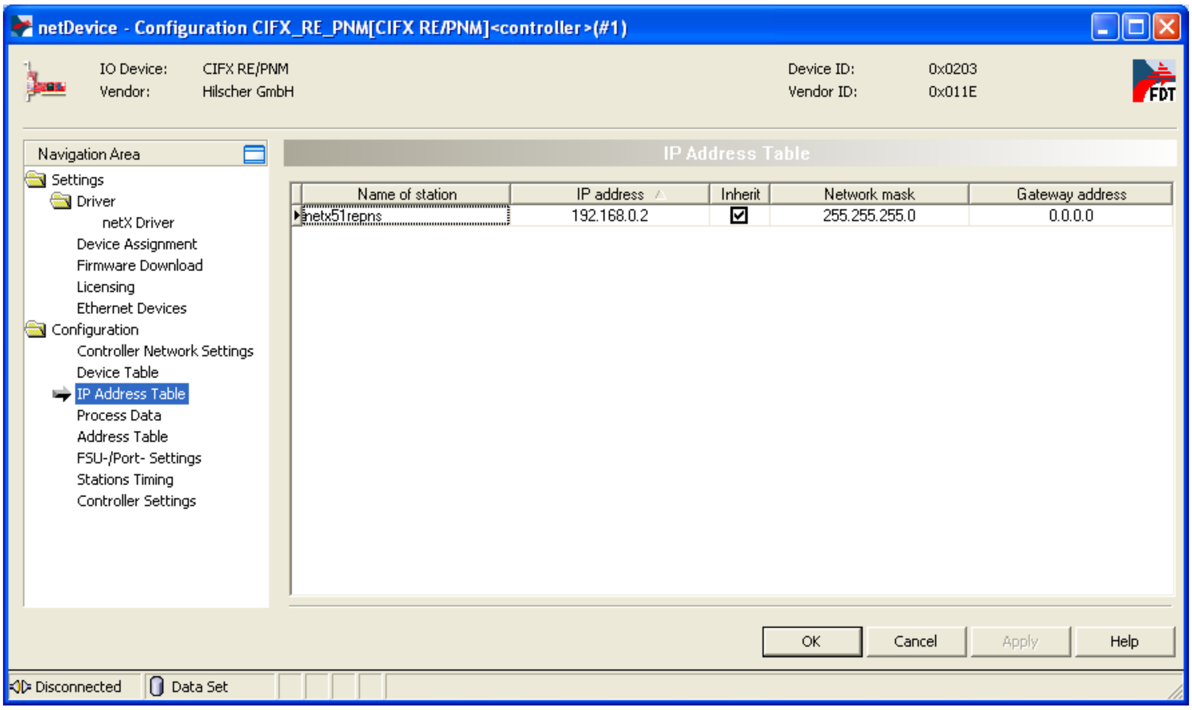
Activate	Index	Name of station	Device	Description	Vendor
☑	1	netx51repns	NETX 51 RE/PNS V3.5.1	NETX_51_RE_PNS_V3.5.1	Hilscher Gesellschaft für Syster

Figure 88: Device Table

- ➢ Make sure that the **Activate** field is checked. Alter the station name of the NXHX board (IO Device), if you need to.

Note: If you have already downloaded the IO Device configuration to the NXHX board and you alter the preset **Name of Station** here, you must download the IO Device configuration to the NXHX board again.

- ➢ In the **Navigation Area**, choose **Configuration** > **IP Address Table**.
- ➭ The **IP Address Table** dialog window opens:



netDevice - Configuration CIFX_RE_PNM[CIFX RE/PNM]<controller>(#1)

IO Device: CIFX RE/PNM
Vendor: Hilscher GmbH
Device ID: 0x0203
Vendor ID: 0x011E

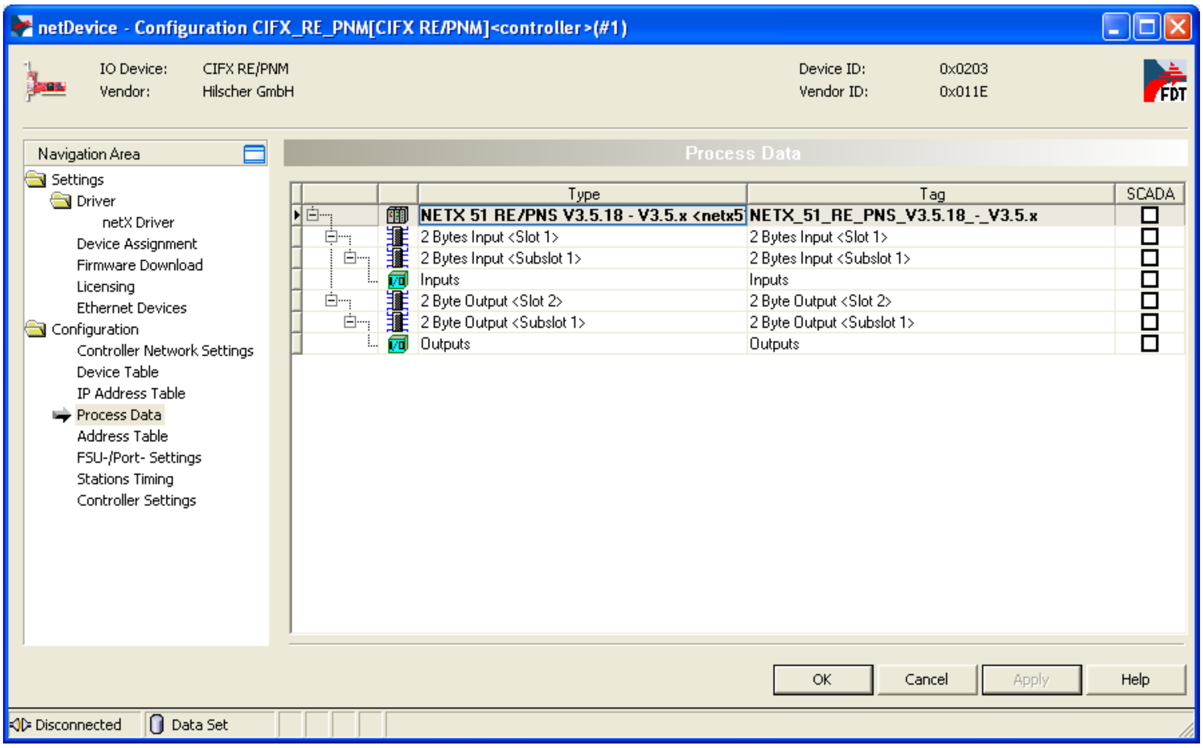
IP Address Table

Name of station	IP address	Inherit	Network mask	Gateway address
netx51repns	192.168.0.2	☑	255.255.255.0	0.0.0.0

Figure 89: IP Address Table

- ➢ Alter the IP address of the NXHX board (IO Device), if you need to.

- ➢ In the **Navigation Area**, choose **Configuration** > **Process Data**.
- ➮ The **Process Data** dialog window opens:



netDevice - Configuration CIFX_RE_PNM[CIFX RE/PNM]<controller>(#1)

IO Device: CIFX RE/PNM
Vendor: Hilscher GmbH

Device ID: 0x0203
Vendor ID: 0x011E

Process Data

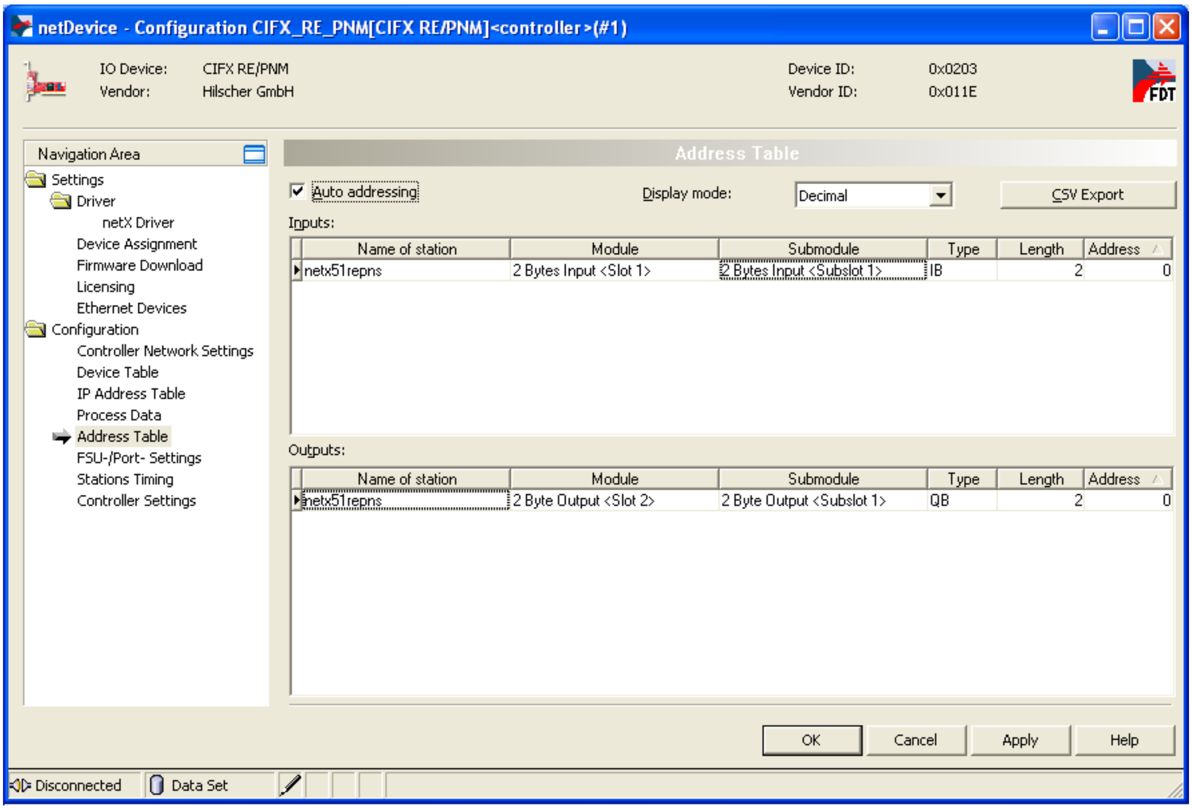
Type	Tag	SCADA
NETX 51 RE/PNS V3.5.18 - V3.5.x <netx5	NETX_51_RE_PNS_V3.5.18_-_V3.5.x	□
2 Bytes Input <Slot 1>	2 Bytes Input <Slot 1>	□
2 Bytes Input <Subslot 1>	2 Bytes Input <Subslot 1>	□
Inputs	Inputs	□
2 Byte Output <Slot 2>	2 Byte Output <Slot 2>	□
2 Byte Output <Subslot 1>	2 Byte Output <Subslot 1>	□
Outputs	Outputs	□

Figure 90: Process Data

- ➢ Review the mapping of the input and output data.

➢ In the **Navigation Area**, choose **Configuration** > **Address Table**.

➯ The **Address Table** dialog window opens:



netDevice - Configuration CIFX_RE_PNM[CIFX RE/PNM]<controller>(#1)

IO Device: CIFX RE/PNM
Vendor: Hilscher GmbH
Device ID: 0x0203
Vendor ID: 0x011E

Address Table

☑ Auto addressing
Display mode: Decimal

Inputs:

Name of station	Module	Submodule	Type	Length	Address
netx51repns	2 Bytes Input <Slot 1>	2 Bytes Input <Subslot 1>	IB	2	0

Outputs:

Name of station	Module	Submodule	Type	Length	Address
netx51repns	2 Byte Output <Slot 2>	2 Byte Output <Subslot 1>	QB	2	0

Figure 91: Address Table

➢ Review the **Address Table**. The parameters are preset.

Note: Keep the preset parameters in the **FSU-/Port-Settings**, **Stations Timing** and **Controller Settings** dialog windows.
If you nevertheless alter the **Stations Timing** parameters after having already downloaded the IO Device configuration to the NXHX board, you must afterwards download the IO Device configuration to the NXHX board again.

➢ Click **OK** button to close the configuration dialog.

➯ You have configured the PC Card cifX (IO Controller).

11. Download configuration to PC Card cifX (IO Controller).

➢ Select the **CIFX_RE_PNM** symbol and use the right mouse button to open the context menu.

➢ In the context menu, select **Download**.

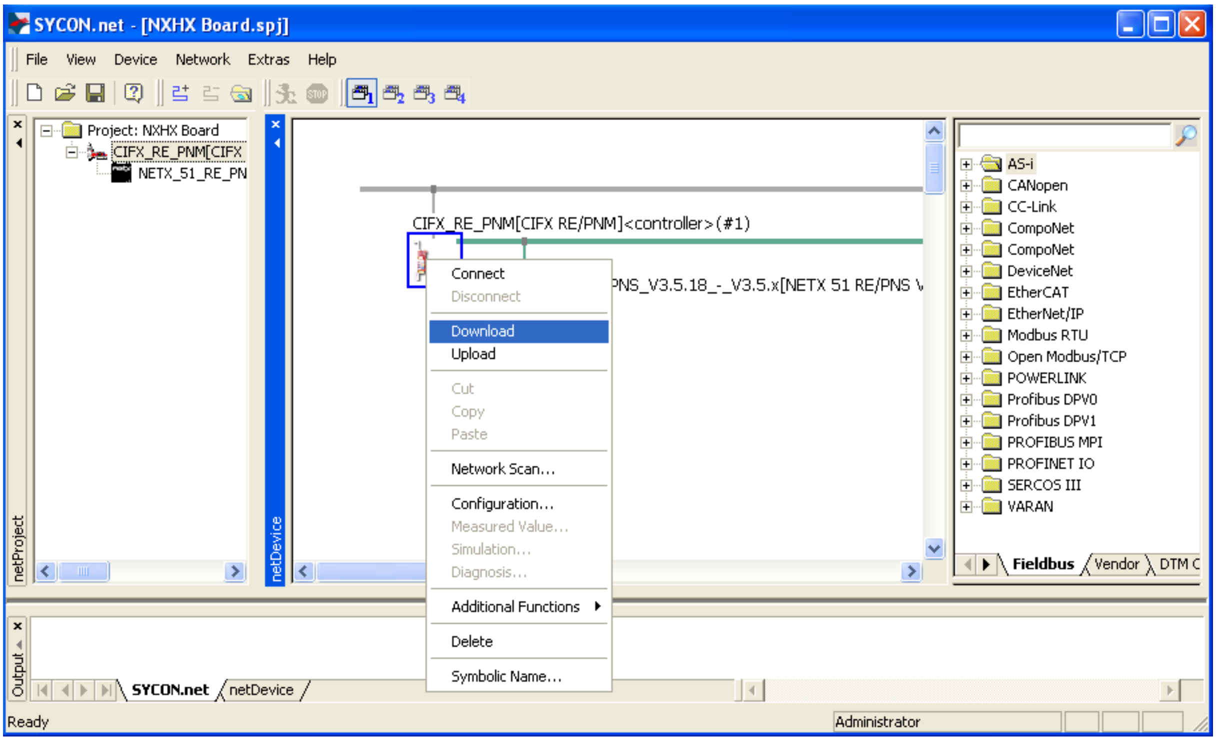


Figure 92: Download Configuration to PC Card cifX

➢ Answer the configuration download confirmation request with **Yes**.

➩ The configuration is downloaded to the PC Card cifX.
The communication status LED **COM 1** on the NXHX board blinks red for a few seconds (see position ④ in *Device Drawing and Positions of the NXHX 51-ETM* chapter on page 16). Once the PC Card cifX has successfully established communication with the NXHX board, the LED **COM 1** goes off.

5.10 Testing I/O Communication

5.10.1 Overview

This section describes how to test the I/O data exchange between the NXHX board (PROFINET IO Device) and the PC card cifX (PROFINET IO Controller). In this test setup, the NXHX board is connected to the configuration PC via **Host Interface** and **NXPCA-PCI Adapter Board**. The configuration PC serves as host system for the NXHX board, the Hilscher **cifX Test Application** running on the PC simulates a host application for the NXHX board (i. e. the IO Device) enabling you to exchange I/O data with the IO Controller. The configuration PC is also the host system for the PC Card cifX, which is connected to the PCI interface of the PC. The **IO Monitor** feature of **SYCON.net** running on the configuration PC simulates a host application for the PC Card cifX (i. e. the PROFINET IO Controller) enabling you to exchange I/O data with the IO Device.

5.10.2 Prerequisites

- You have configured the NXHX board and the PC Card cifX (see *Configuring NXHX 51-ETM With SYCON.net* section on page 75).
- The NXHX board is connected to the configuration PC via **NXPCA-PCI Adapter Board** and **CAB-NXPCA-PCI** cable. Instructions for this can be found in the *Downloading NXF Firmware via PCI and Host Interface* section on page 63.
- You have installed the **SYCON.net** configuration software version 1.360 or higher on your PC. (On the NXHX 51-ETM product DVD, open the `Software\SYCON.net` directory, then double-click **SYCONnet netX setup.exe** file. Follow the instructions of the installation wizard.)
- You have installed the **cifX Device Driver** on your PC. (On the NXHX 51-ETM product DVD, open the `Driver and Toolkit\Device Driver (NXDRV-WIN)\Installation` directory, then double-click **cifX Device Driver Setup.exe** file. Follow the instructions of the installation wizard.)
  The cifX Device Driver installation contains the **cifX Test Application**, which can be used for testing I/O data exchange of the NXHX board.
- You have installed a PC Card **CIFX 50-RE** in your configuration PC. For details, please refer to the User Manual *PC Cards CIFX 50 50E 70E 100EH*, DOC120204UMxxEN.
- The NXHX board is connected to a voltage supply.
- The NXHX board is connected to the PC Card CIFX 50-RE via Ethernet cable.

5.10.3 Step-by-Step Instructions

1. Establish online connection between SYCON.net and the PC Card cifX.

- ➢ Open your configuration project in SYCON.net.
- ➢ Select the **CIFX_RE_PNM** symbol and use the right mouse button to open the context menu.
- ➢ In the context menu, select **Connect**.

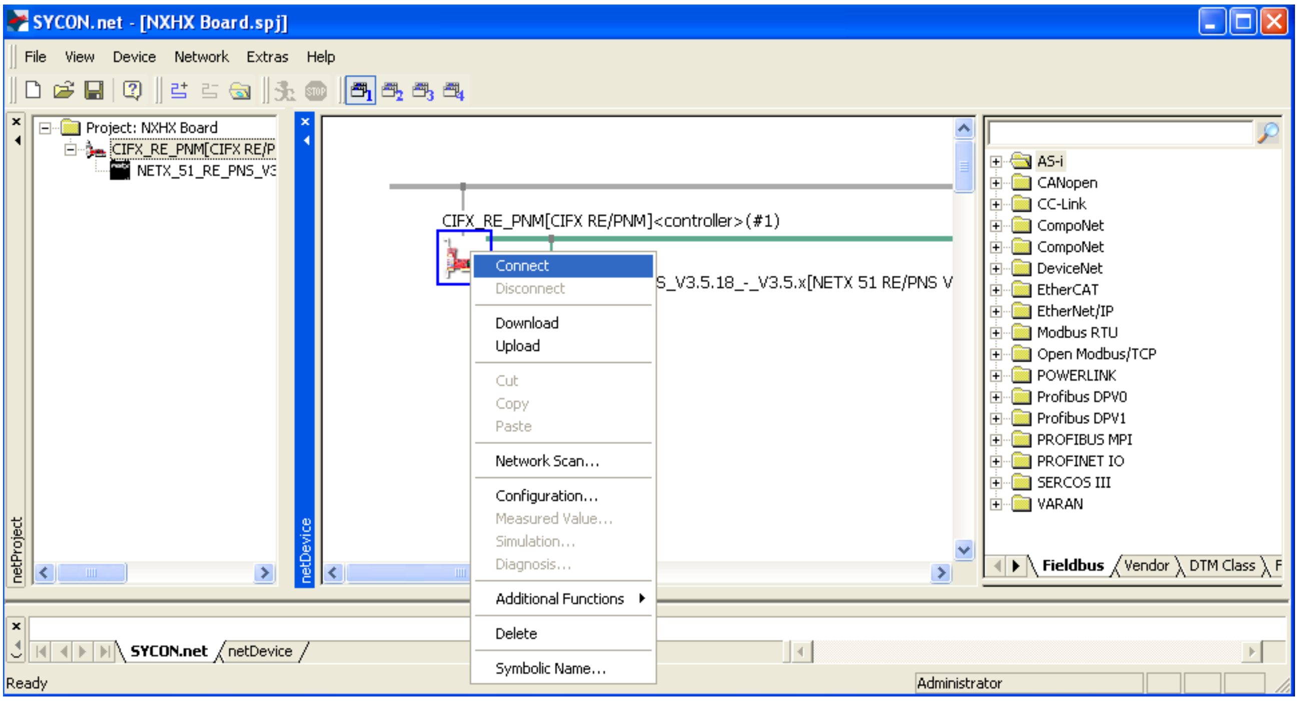


Figure 93: Establish Online Connection With PC Card cifX

➮ SYCON.net establishes an online connection with the PC Card cifX. This is indicated by a green label above the symbol of the PC Card cifX.

2. Open Diagnosis for PC Card cifX (IO Controller) in SYCON.net.

➢ Select the **CIFX_RE_PNM** symbol and use the right mouse button to open the context menu.

➢ In the context menu, select **Diagnosis…**

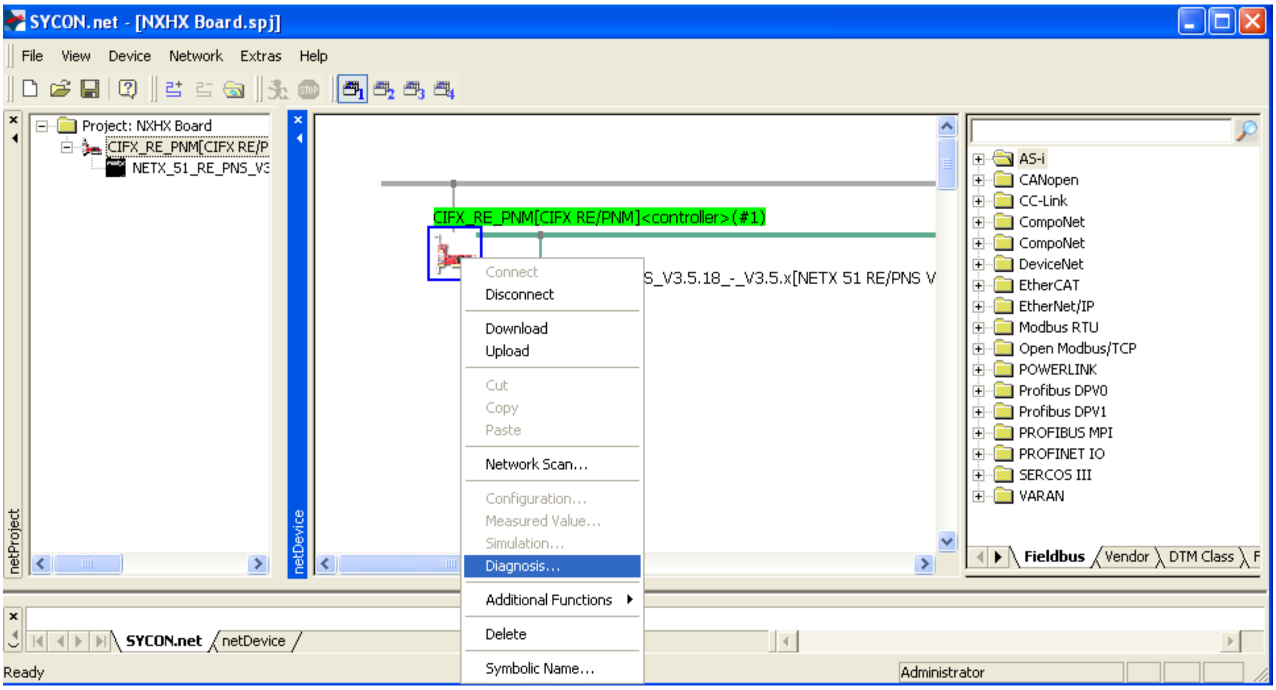
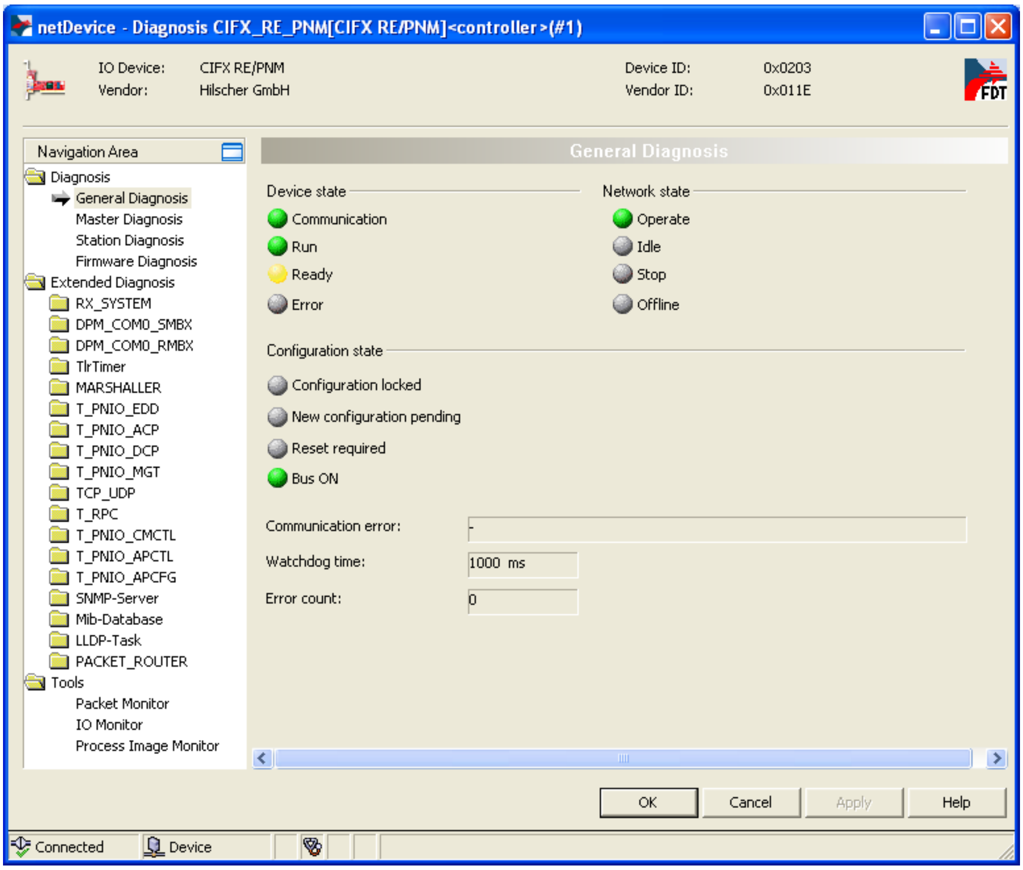


Figure 94: Open Diagnosis Dialog for PC Card cifX

➭ The **General Diagnosis** dialog window opens:


netDevice - Diagnosis CIFX_RE_PNM[CIFX RE/PNM]<controller>(#1)

IO Device: CIFX RE/PNM
Vendor: Hilscher GmbH
Device ID: 0x0203
Vendor ID: 0x011E

Communication error: -
Watchdog time: 1000 ms
Error count: 0

Figure 95: General Diagnosis for PC Card cifX

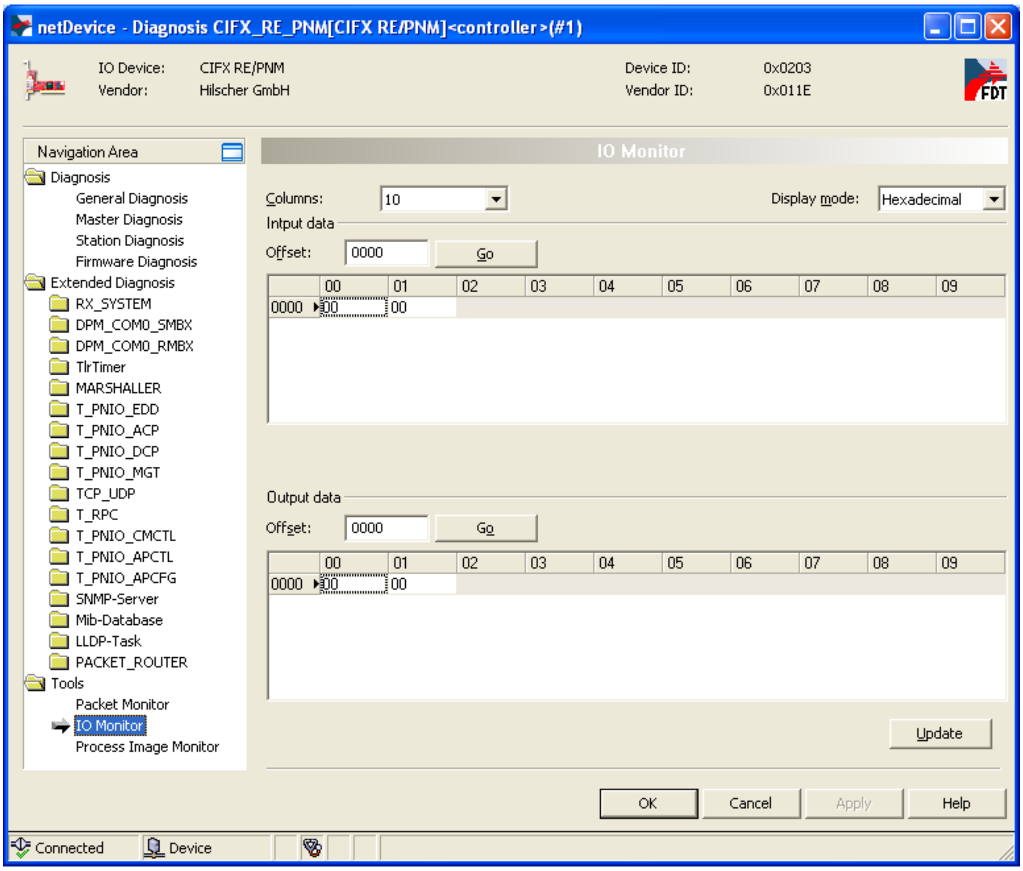
© Hilscher 2013

- ➢ Check, whether the LEDs for **Communication**, **Operate**, **Run** and **Bus ON** are green. If this is the case, a functioning communication between the PC Card cifX and the NXHX board has been established.

3. Open IO Monitor.

- ➢ In the **Navigation Area**, choose **Tools** > **IO Monitor**.

- ➯ The **IO Monitor** dialog window opens:


netDevice - Diagnosis CIFX_RE_PNM[CIFX RE/PNM]<controller>(#1)

IO Device: CIFX RE/PNM
Vendor: Hilscher GmbH
Device ID: 0x0203
Vendor ID: 0x011E

IO Monitor

Columns: 10
Display mode: Hexadecimal

Intput data
Offset: 0000

	00	01	02	03	04	05	06	07	08	09
0000	00	00								

Output data
Offset: 0000

	00	01	02	03	04	05	06	07	08	09
0000	00	00								

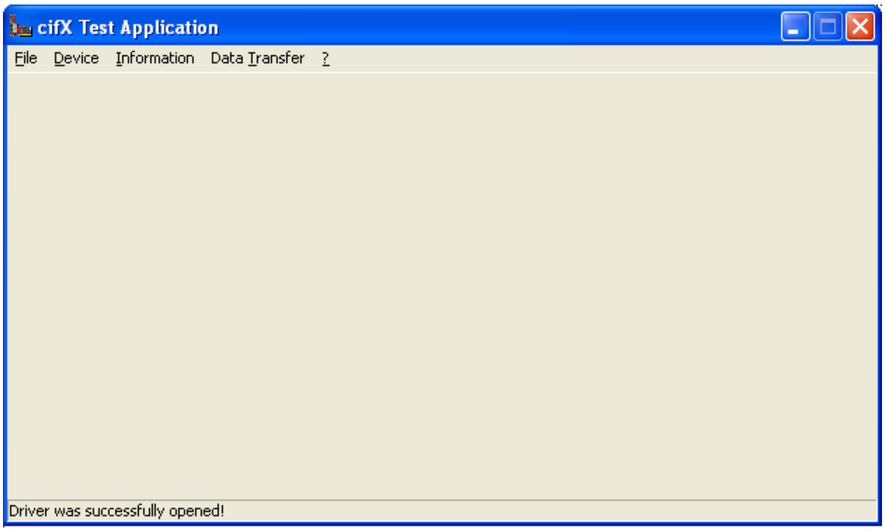
Figure 96: IO Monitor for PC Card cifX

- ➢ Leave the **IO Monitor** dialog window open while changing to the **cifX Test Application** in the next step.

4. Open the **cifX Test Application** on your PC.

➢ In the Windows **Start** menu, choose **Control Panel** > **cifX Test**.

➩ The **cifX Test Application** opens:



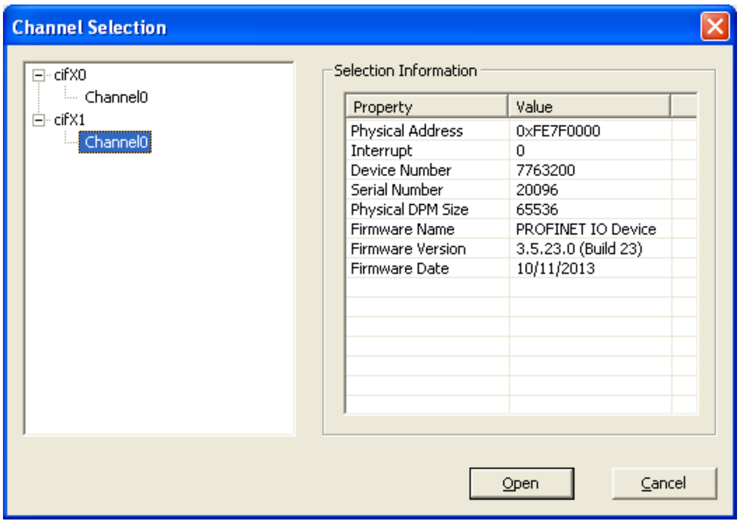
Driver was successfully opened!

Figure 97: cifX Test Application Start Screen

5. Open connection to NXHX board.

➢ In the menu, choose **Device** > **Open** and wait for a few seconds.

➩ After a while, the **Channel Selection** dialog box opens:



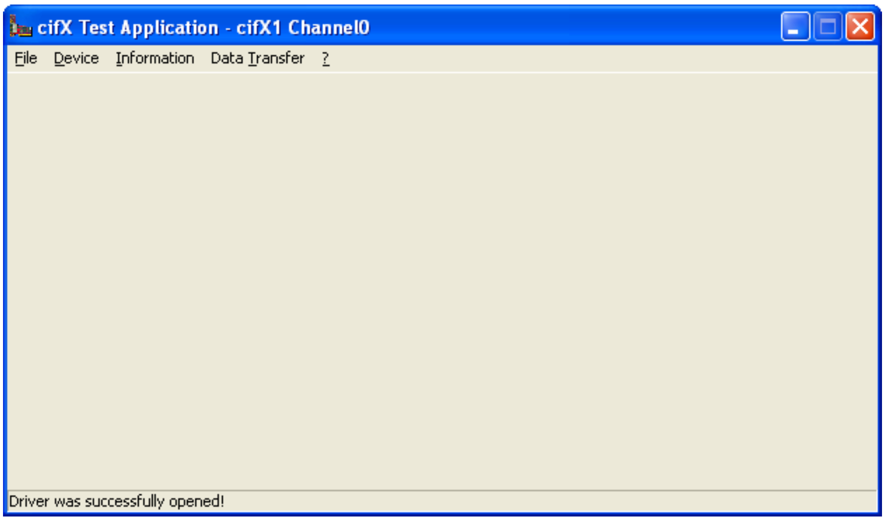
Property	Value
Physical Address	0xFE7F0000
Interrupt	0
Device Number	7763200
Serial Number	20096
Physical DPM Size	65536
Firmware Name	PROFINET IO Device
Firmware Version	3.5.23.0 (Build 23)
Firmware Date	10/11/2013

Figure 98: Channel Selection Dialog

➢ In the left part of the dialog box, select the channel of the cifX driver to which the NXHX board is connected via **Host Interface** and **NXPCA-PCI Adapter Board**. The PROFINET IO Controller (i. e. the PC Card cifX) is also connected to the cifX driver, therefore check in the **Selection Information** area on the right side, whether you have selected the correct channel (i. e. the channel for the PROFINET IO Device.

➢ After selecting the channel for the PROFINET IO Device (i. e. the NXHX board), click **Open** button.

➮ The **Channel Selection** dialog box closes, and back in the **cifX Test Application** window, the header displays the selected channel:



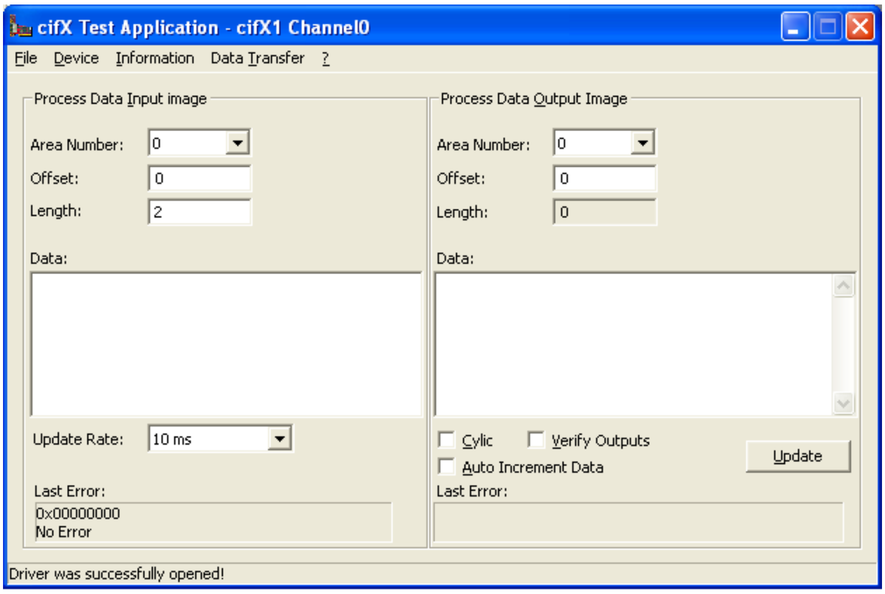
Driver was successfully opened!

Figure 99: cifX Test Application After Channel Selection

6. Send I/O Output data from IO Device to IO Controller.

➢ In the menu, choose **Data Transfer** > **I/O Data**.

➮ The **Process Data I/O Image** dialog window opens.



Process Data Input image

Area Number: 0

Offset: 0

Length: 2

Data:

Update Rate: 10 ms

Last Error:

0x00000000
No Error

Process Data Output Image

Area Number: 0

Offset: 0

Length: 0

Data:

□ Cylic □ Verify Outputs

□ Auto Increment Data

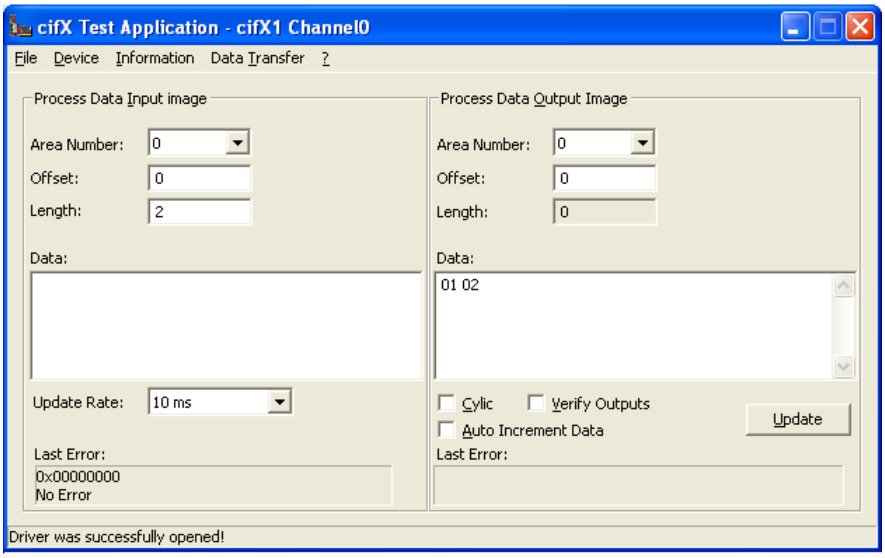
Last Error:

Driver was successfully opened!

Figure 100: I/O Data Dialog in cifX Test Application

➢ In the **Length** field of the **Process Data Input Image** area, enter the value **2**. This is the number of Bytes which can be received.

➢ In the **Data** field of the **Process Data Output Image** area, enter output data that can be sent to the PROFINET IO Controller (i. e. the PC Card cifX). Keep in mind, that the PROFINET IO Device firmware for testing and evaluation purposes is limited to two Bytes IO data exchange. For instance, you can enter the value **01 02**.


cifX Test Application - cifX1 Channel0
File Device Information Data Transfer ?

Process Data Input image

Area Number: 0
Offset: 0
Length: 2
Data:
Update Rate: 10 ms
Last Error:
0x00000000
No Error

Process Data Output Image

Area Number: 0
Offset: 0
Length: 0
Data:
01 02

□ Cylic □ Verify Outputs
□ Auto Increment Data
Last Error:

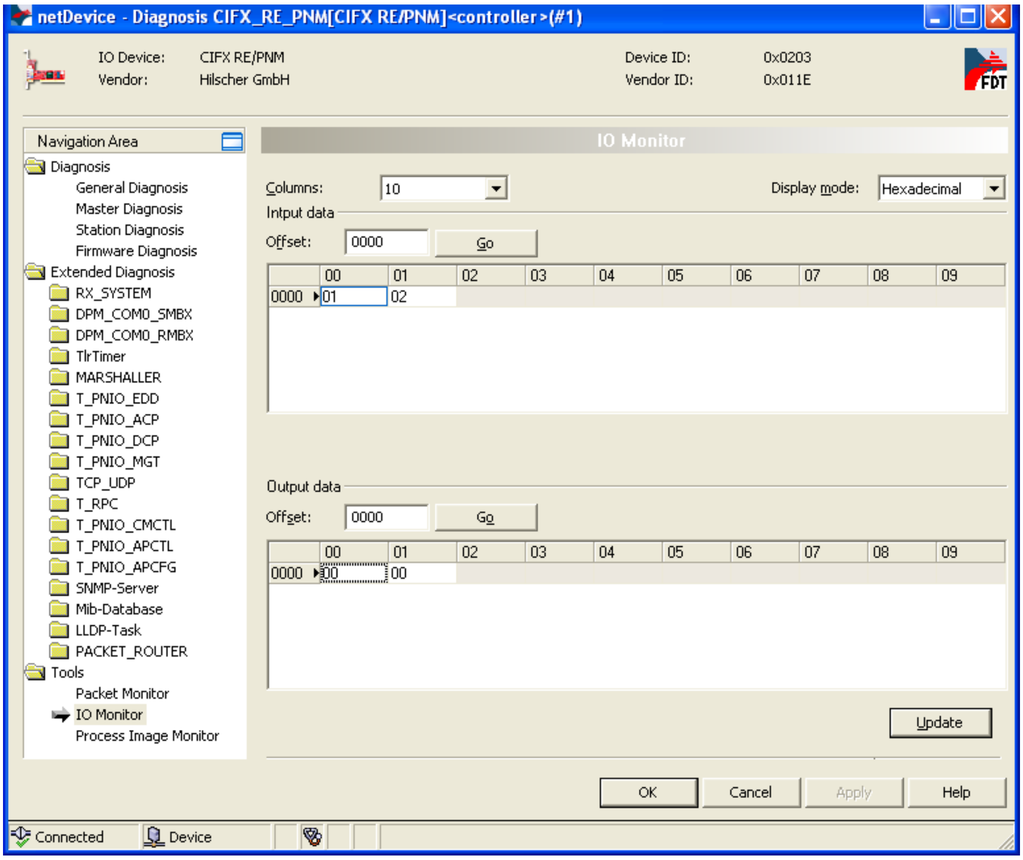
Driver was successfully opened!

Figure 101: Enter Output Data in cifX Test Application

- ➢ After having entered the output data, click **Update**.
- ➪ The data is sent from the PROFINET IO Device (i. e. the NXHX board) to the IO Controller (i. e. the PC Card cifX) via Ethernet cable.

7. Read I/O data from IO Device in SYCON.net IO Monitor.

- ➢ Change to the **IO Monitor** window in SYCON.net.



IO Device: CIFX RE/PNM
Vendor: Hilscher GmbH
Device ID: 0x0203
Vendor ID: 0x011E

Columns: 10
Display mode: Hexadecimal

Intput data

Offset: 0000

	00	01	02	03	04	05	06	07	08	09
0000	01	02								

Output data

Offset: 0000

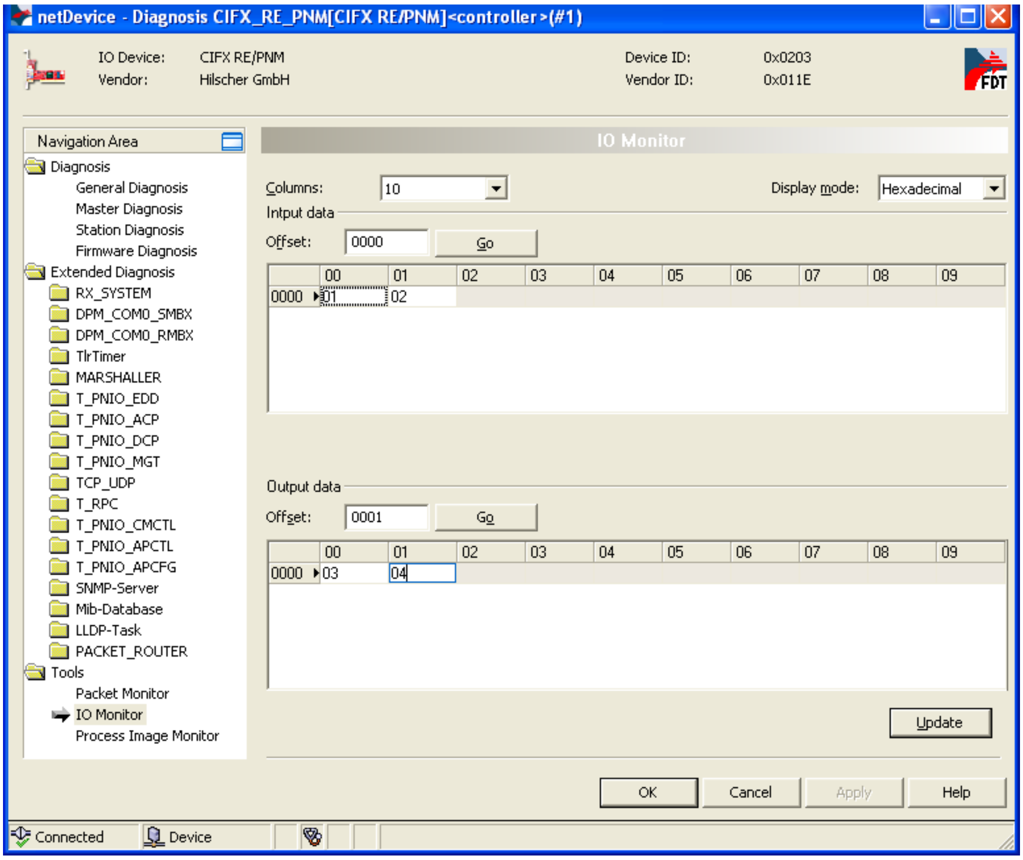
	00	01	02	03	04	05	06	07	08	09
0000	00	00								

Figure 102: Incoming Data in IO Monitor

- ➪ The data which has been sent from the PROFINET IO Device (i. e. the NXHX board) is displayed in the **Input data** area of the **IO Monitor**.

8. Send I/O Output data from IO Controller to IO Device.

- ➢ In the **Output data** area of the **IO Monitor**, enter output data that can be sent from the PROFINET IO Controller (i. e. the PC Card cifX) to the PROFINET IO Device (i. e. the NXHX board). For instance, you can enter the value **03 04**.



netDevice - Diagnosis CIFX_RE_PNM[CIFX RE/PNM]<controller>(#1)

IO Device: CIFX RE/PNM
Vendor: Hilscher GmbH
Device ID: 0x0203
Vendor ID: 0x011E

IO Monitor

Columns: 10
Display mode: Hexadecimal

Intput data
Offset: 0000

	00	01	02	03	04	05	06	07	08	09
0000	01	02								

Output data
Offset: 0001

	00	01	02	03	04	05	06	07	08	09
0000	03	04								

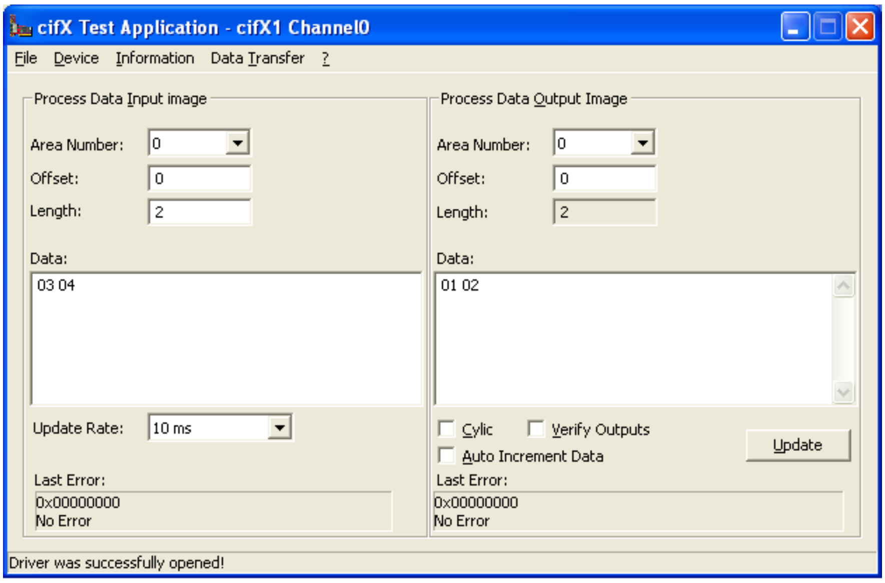
Figure 103: Output Data in IO Monitor

- ➢ After having entered the output data, click **Update**.
- ➪ The data is sent from the PROFINET IO Controller (i. e. the PC Card cifX) to the IO Device (i. e. the NXHX board) via Ethernet cable.

9. Read I/O data from IO Controller in cifX Test Application.

➢ Change to the cifX Test Application.

➾ The data which has been sent from the PROFINET IO Controller (i. e. the PC Card cifX) is displayed in the **Data** field of **Process Data Input Image** area of the cifX Test Application.



Process Data Input image

Area Number: 0

Offset: 0

Length: 2

Data:

03 04

Update Rate: 10 ms

Last Error:
0x00000000
No Error

Process Data Output Image

Area Number: 0

Offset: 0

Length: 2

Data:

01 02

□ Cylic □ Verify Outputs

□ Auto Increment Data

Last Error:
0x00000000
No Error

Driver was successfully opened!

Figure 104: Incoming Data in cifX Test Application

6 Appendix

6.1 List of Figures

Figure 1: NXHX51-ETM Printed Circuit Board 16
Figure 2: Connect Power Supply 18
Figure 3: Command Prompt in Windows XP 20
Figure 4: Change Directory in Command Prompt 21
Figure 5: Execute Build.bat 21
Figure 6: Opened wscript File 23
Figure 7: Command Prompt in Windows XP 23
Figure 8: Change Directory in Command Prompt 24
Figure 9: Execute waf.bat with Target and Build Options 24
Figure 10: Delete Obsolete Commands in Build.bat File 25
Figure 11: Build.bat File After Deleting Obsolete Commands 26
Figure 12: Edited Build.bat File 26
Figure 13: System Properties in Windows XP 29
Figure 14: Environment Variables in Windows XP 29
Figure 15: New System Variable in Windows XP 30
Figure 16: System and Security Sheet in Windows 7 30
Figure 17: System Sheet in Windows 7 31
Figure 18: Advanced System Properties in Windows 7 31
Figure 19: Environment Variables in Windows 7 32
Figure 20: New System Variable in Windows 7 32
Figure 21: HiTOP Start 34
Figure 22: Select Project File Dialog 35
Figure 23: Select Compiler Dialog 35
Figure 24: Select Compiler Dialog 35
Figure 25: Project in HiTOP 36
Figure 26: Project Settings 36
Figure 27: Tool Settings 37
Figure 28: Project in HiTOP 38
Figure 29: Project in HiTOP (2) 39
Figure 30: Connection Description 40
Figure 31: Connect To Dialog 40
Figure 32: COM Port Properties 41
Figure 33: rcX UART Example in HyperTerminal 41
Figure 34: Bootwizard Start Screen 42
Figure 35: Select ELF File Dialog 43
Figure 36: ELF File Loaded 44
Figure 37: Generate Boot Image Screen 45
Figure 38: Bootwizard Start Screen 47
Figure 39: Bootwizard Write to Flash Screen 48
Figure 40: Select Input File Dialog 48
Figure 41: Bootwizard Message 49
Figure 42: Selected File in Write to Flash Screen 49
Figure 43: Check USB Connection to netX 51 Bootmonitor in Windows XP 51
Figure 44: Check USB Connection to netX 51 in Windows 7 52
Figure 45: Write to Flash Screen 53
Figure 46: Plugin Selector for netX 51 Rom Loader 53
Figure 47: Progress Window 54
Figure 48: Flashing Successful Message 54

Figure 49: Check USB Connection to netX 51 in Windows XP 58
Figure 50: Check USB Connection to netX 51 in Windows 7 58
Figure 51: netHOST Device Test Application Start Screen 59
Figure 52: Channel Selection Dialog 59
Figure 53: netHOST Device Test Application After Channel Selection 60
Figure 54: Download Window 60
Figure 55: File Selection 61
Figure 56: Firmware Download in Progress 61
Figure 57: Connecting NXHX Board to PC via Adapter Board 64
Figure 58: Settings for DPM 67
Figure 59: Disable NXPCA-PCI in Device Manager (Windows XP) 68
Figure 60: Enable NXPCA-PCI in Device Manager (Windows XP) 69
Figure 61: Control Panel in Windows XP 69
Figure 62: Control Panel in Windows 7 70
Figure 63:All Control Panel Items in Windows 7 70
Figure 64: cifX Driver Setup Utility Start Screen 71
Figure 65: cifX Driver Setup Utility - Active Devices 72
Figure 66: cifX Driver Setup Utility – Open File Dialog 72
Figure 67: cifX Driver Setup Utility – Selected Firmware File 73
Figure 68: Device Restart Request 73
Figure 69: Device Still Accessed Warning 74
Figure 70: SYCON.net Login 76
Figure 71: Empty Project in SYCON.net 77
Figure 72: Define CIFX 50 as PROFINET IO Controller in SYCON.net 77
Figure 73: Define NXHX Board as PROFINET IO Device in SYCON.net 78
Figure 74: Choose Driver for PC Card cifX 79
Figure 75: Assign Driver to PC Card cifX 80
Figure 76: Firmware Download Dialog in SYCON.net 81
Figure 77: Select Firmware File Dialog in SYCON.net 81
Figure 78: Downloading Firmware to PC Card cifX 82
Figure 79: Choose Driver for NXHX Board 83
Figure 80: Configuration Dialog NXHX Board 84
Figure 81: Assign Driver to NXHX Board 85
Figure 82: Modules Dialog of NXHX Board 86
Figure 83: Define Input Module of NXHX Board 87
Figure 84: Define Output Module of NXHX Board 87
Figure 85: Download Configuration to NXHX Board 88
Figure 86: Disconnect IO Controller in SYCON.net 89
Figure 87: Controller Network Settings 90
Figure 88: Device Table 91
Figure 89: IP Address Table 92
Figure 90: Process Data 93
Figure 91: Address Table 94
Figure 92: Download Configuration to PC Card cifX 95
Figure 93: Establish Online Connection With PC Card cifX 97
Figure 94: Open Diagnosis Dialog for PC Card cifX 98
Figure 95: General Diagnosis for PC Card cifX 98
Figure 96: IO Monitor for PC Card cifX 99
Figure 97: cifX Test Application Start Screen 100
Figure 98: Channel Selection Dialog 100
Figure 99: cifX Test Application After Channel Selection 101
Figure 100: I/O Data Dialog in cifX Test Application 101
Figure 101: Enter Output Data in cifX Test Application 102

Figure 102: Incoming Data in IO Monitor 102
Figure 103: Output Data in IO Monitor 103
Figure 104: Incoming Data in cifX Test Application 104

6.2 List of Tables

Table 1: List of Revisions 4
Table 2: List of Positions on Printed Circuit Board 17
Table 3: Settings for Serial Boot Mode at Switch S1 50
Table 4: Set Flash Boot Mode at Switch S1 54
Table 5: Set Flash Boot Mode at Switch S1 57
Table 6: 16 Bit Mode at Switch S2 for Hardware Revision 3 66
Table 7: 16 Bit Mode at Switch S2 for Hardware Revision 4 66
Table 8: Set X10 Jumper for Dual-Port Memory 66
Table 9: Set Flash Boot Mode at Switch S1 67
Table 10: Enable SecMem and Flash Boot Mode at Switch S1 76

6.3 Contacts

Headquarters

Germany
Hilscher Gesellschaft für
Systemautomation mbH
Rheinstrasse 15
65795 Hattersheim
Phone: +49 (0) 6190 9907-0
Fax: +49 (0) 6190 9907-50
E-Mail: info@hilscher.com

Support
Phone: +49 (0) 6190 9907-99
E-Mail: de.support@hilscher.com

Subsidiaries

China
Hilscher Systemautomation (Shanghai) Co. Ltd.
200010 Shanghai
Phone: +86 (0) 21-6355-5161
E-Mail: info@hilscher.cn

Support
Phone: +86 (0) 21-6355-5161
E-Mail: cn.support@hilscher.com

France
Hilscher France S.a.r.l.
69500 Bron
Phone: +33 (0) 4 72 37 98 40
E-Mail: info@hilscher.fr

Support
Phone: +33 (0) 4 72 37 98 40
E-Mail: fr.support@hilscher.com

India
Hilscher India Pvt. Ltd.
New Delhi - 110 065
Phone: +91 11 43055431
E-Mail: info@hilscher.in

Italy
Hilscher Italia S.r.l.
20090 Vimodrone (MI)
Phone: +39 02 25007068
E-Mail: info@hilscher.it

Support
Phone: +39 02 25007068
E-Mail: it.support@hilscher.com

Japan
Hilscher Japan KK
Tokyo, 160-0022
Phone: +81 (0) 3-5362-0521
E-Mail: info@hilscher.jp

Support
Phone: +81 (0) 3-5362-0521
E-Mail: jp.support@hilscher.com

Korea
Hilscher Korea Inc.
Suwon, Gyeonggi, 443-734
Phone: +82 (0) 31-695-5515
E-Mail: info@hilscher.kr

Switzerland
Hilscher Swiss GmbH
4500 Solothurn
Phone: +41 (0) 32 623 6633
E-Mail: info@hilscher.ch

Support
Phone: +49 (0) 6190 9907-99
E-Mail: ch.support@hilscher.com

USA
Hilscher North America, Inc.
Lisle, IL 60532
Phone: +1 630-505-5301
E-Mail: info@hilscher.us

Support
Phone: +1 630-505-5301
E-Mail: us.support@hilscher.com

© Hilscher 2013